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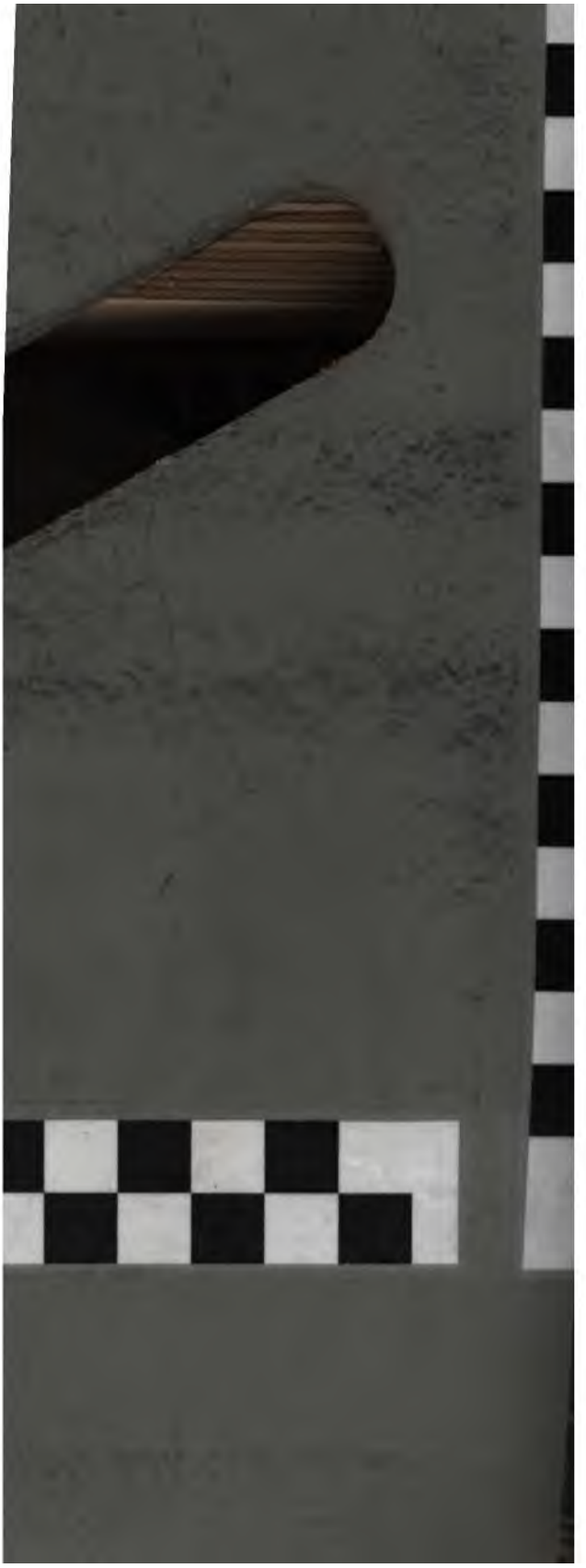

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HENRY LEE DODGE MEMORIAL

DISEASES OF SWINE

WITH PARTICULAR REFERENCE TO

HOG-CHOLERA

BY

CHARLES F. LYNCH, M. D., D. V. S.

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WITH A CHAPTER ON

CASTRATION AND SPAYING

BY

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PREFACE

In writing this work it has been the object of the author to prepare a book to meet the constantly increasing demand for a volume that will give an intelligent interpretation of recent advances in the study of pathology of diseases of the hog, and the application of the newer therapeutic discoveries in their treatment.

No single branch of agricultural industry has made as rapid advancement in the past twenty-five years as the swine-producing business. It is only a short time ago that hogs were practically a drug on the market. I can remember in the late 90's when fat hogs sold for 3 cents a pound live weight in the Corn Belt States. This same class of hogs to-day are worth from 9 to 11 cents a pound.

This enormous increase in the value of hogs from a financial standpoint has given a marked stimulus to the swine-producing industry, and has developed a desire on the part of hog owners to give their sick hogs the very best possible attention, as the death of one of these animals means a large financial loss. The veterinarian has also been called upon more frequently to treat sick hogs, and this part of his practice is becoming a considerable item in the business of every practising veterinarian.

The development of hog-cholera serum as a means for management of hog-cholera has given an added stimulus in the past ten years to the demand for scientific treatment of sick hogs. Both veterinarian and farmer have been quick to realize the importance of this new means of treatment, and there is a widespread demand for complete explanation of the underlying scientific basis for this means of combating the disease.

In this work it has been my especial aim to explain the principles of manufacture and use of hog-cholera serum in such a

manner as to make it intelligible to stockman and veterinarian alike. This is at present the main field of swine pathology and practice, and if I have succeeded in accomplishing this object I feel well repaid for the time and labor involved in compiling the work.

I wish to acknowledge my indebtedness to the works of many modern authors for helpful information, and especially so to Dr. Craig, of Purdue University; Dr. Kaupp, of Spartanburg, S. C.; and Prof. Plumb, of Ohio State University. The works of these authors have been the source of many valuable points in their respective fields.

I also wish to extend thanks to the many State and Federal officials who have aided me in every possible manner. Appreciation is especially due Dr. George R. White, State Veterinarian of Tennessee, for many valuable suggestions and the excellent article on Castration and Spaying, as well as numerous photographs; Dr. John R. Mohler, of the United States Bureau of Animal Industry; Dr. M. I. Dorset, Dr. W. B. Niles, and many others who have freely assisted me in many ways.

I also wish to thank the many breeders and swine-breeding associations for their help in preparing and illustrating the section on Breeds and Breeding of Swine.

CHARLES F. LYNCH.

324 SOUTH THIRD STREET,
TERRE HAUTE, IND.

November, 1914.

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DISEASES OF SWINE

THE GREAT AMERICAN HOG

In the United States the development and breeding of hogs has reached the highest point of perfection, and the great American hog may well be looked upon as the king of his breed. In no other country in the world has the production of market hogs reached the high degree of perfection seen in American feed lots. Especially is this perfection in type of hogs to be seen throughout the states comprising the so-called Corn Belt. In these states hog raising is the king of industries, and more time and attention is devoted to breeding of swine in this section of our country than in any other part of the world.

Hog raising is largely a money-producing investment in our country, and the American type of hog is not the style of animal that is looked upon with favor in other countries. The American farmer desires a hog that will produce the largest possible amount of money in the shortest possible amount of time and with the least possible amount of feed. Hogs are raised by the Corn Belt farmer for the money there is in them as well as the pleasure to be derived from producing prize stock. As a result of these desires, we find that the American type of swine has largely been developed with the view of obtaining a hog that possesses compactness of form, a wide back, full, heavy hams, short limbs, and that will show the greatest possible gain in weight on the least possible amount of feed, and which matures at a very early date. There is no other animal that matures and becomes marketable as rapidly as the United States hog, and no other species of farm live-stock shows as large and as quick returns upon the feed given as the hog. It is no wonder that the hog-producing industry has shown such

marked growth in the Corn Belt. An animal that is capable of showing the returns produced by the hog is indeed worthy of attention and care.

THE LARD HOG

The hog that finds most favor in the United States is a heavy producer of fat, especially showing a heavy deposit of leaf-lard fat and subcutaneous fat beneath the skin. This type is seen in its most perfect development in the Middle West, where corn forms a large article of diet. This kind of hog is commonly referred to as the lard hog, and does not meet with especial favor in other countries, where the bacon type is more sought for.

Favorite American Type.—The important desirable features of the American hog, from the standpoint of the Corn Belt farmers, is compactness of body, short limbs, well boned, and with strong joints, short head, broad back, deep body, heavy hams, and covered by an abundant coat of fine hair. The high-class hog should possess a considerable degree of activity, and yet should be of a mild temperament. The activity and gentleness are important characteristics from the standpoint of breeding. The weight of hog which finds favor in American feed lots is the 300- to 400-pound animal.

POINTS IN SWINE JUDGING

In passing judgment upon a hog intended for breeding purposes, with a view to development of the desirable points above mentioned, the following points are of interest:

Head and Neck.—It is desirable to have the head short and wide. The snout should preferably be short and well formed. The eyes should set reasonably far apart, and should not be surrounded by any excessive deposit of fat. The ears should be of medium size, inclined to be neatly pointed, and set at a proper angle upon the head. In the best type of animal the ears are covered by a fair amount of hair, which is of fine quality and texture. The head and face should be free from any wrinkles or seams that give an unsightly expression. Jowls should be full and firm, rounded in outline, and yet not over fat, so as to hang loose and flabby. The favorite neck is short and thick, and merges smoothly with the body at head and shoulders. Broadness of neck as well as depth is desirable.

Chest and Shoulders.—Proper development of the chest is essential to proper action on the part of the heart and lungs. The favorite type of chest is broad and deep, with the breast-bone located well forward and with a well-marked curve. This indicates a strong constitution and plenty of room for development of those organs which are essential to vigorous growth.

From the market viewpoint a smooth well-fleshed shoulder is highly desirable. There should be absolute smoothness of outline at the junction between shoulders and chest, and no hollowness or roughness at this point. In the boar there is always some noticeable thickness of the skin over the shoulder muscles. This is a characteristic inherited from the wild boar, in which this "shield" was developed as a means of protection in fighting. While a reasonable amount of thickening of the skin in this region is unavoidable, overdevelopment of the "shield" is objectionable, as it may be transmitted to the litter and become an undesirable quality.

Front Legs.—The favorite type of American hog is close built and lies close to the ground. The front legs should be short and well formed, with strong bones and well developed, but not overlarge joints. When facing the animal the front legs should come down on a level with the center of the shoulder, the knees straight, and reasonably wide apart. The toes should be directed forward, and the entire attitude of the animal should be one of ease and comfort. The pastern joint should be well developed, and the rudimentary toes on the back of the leg should be set high enough to clear the ground. In animals that are narrow chested the legs are usually set too close together, and there is a tendency for the knees to bow inward, producing a condition similar to knock-knee. While a coarse, raw-boned animal is not desirable, it is not profitable to develop too fine a bone. Strength as well as neatness are desirable, and a fairly well-developed bony framework is necessary to give proper weight-bearing power.

Back and Loins.—In the favorite type of American hog the broad back and loins are very noticeable characteristics. During the breeding season, when the herd is somewhat run down in flesh, the width of the back may not be so prominent, but as soon as the hog is put upon a full feed of grain there is soon noticeable a remark-

able widening of the loins, a slight arching from before backward, and a uniform development from withers to loins. Tapering toward the loins is not a desirable feature, as this is an indication that the shoulders are overheavy and the loins overlight. The slight arching of the back from before backward is also a desirable characteristic, as it indicates a strong back. Any curving downward of the back is an indication of weakness, and denotes liability to break down in breeding season or when over fat.

Hips and Hams.—In the viewpoint of the packer the hams represent the most valuable part of the entire carcass, and proper development of this part of the body is an important essential. In the high-grade animals the hips are not prominent, but present a neatly molded outline, which gradually merges into the thigh below. The rump usually drops off rather sharply and the tail is set a little low. The most desirable form is that with a broad almost level rump, and with tail set as high as possible. From the tail the hams curve gently and gracefully outward, and then around forward again, to give the proper contour to the twist and hock. When viewed from the side, the desirable ham is decidedly long from the point of the hip to the lower corner of the ham, and is also broad from side to side.

Hind Legs.—The desirable condition of the hind legs is short in length, placed wide apart, and strongly built. One of the most common defects is a cramped condition at the hock joint. In another large number of hogs it is noticed that the animals are higher behind than in front. This is due to the fact that the hind legs are too long. The fleshy part of the ham should be carried well down toward the hock. Absence of this plumpness of the thigh is quite commonly noted, and is a serious defect. When the hog moves about the hind legs and the front legs should move forward in a straight line. When viewed from behind, the hind legs should be well separated, and the ham from between the legs to its outer margin should be broad and well proportioned. Below the hock the hind legs should be straight, well boned, and the animal should rest firmly and easily upon the toes. The pastern joint should be strong, and the weight of the body well supported and easily carried.

Sides.—The desirable qualities in the sides are fulness and

depth, with a well-sprung rib. There should be sufficient length of body to indicate ample room for the digestive tract. Ribs should be well sprung and long, a characteristic which gives an appearance of roundness and smoothness to the body, with greater depth than appearance would indicate. The sides, from shoulder to ham, should be so filled out as to present a perfect line, with no depressions back of the shoulder or in front of the ham. In a perfect animal, if a straight-edge be laid from the shoulder to the ham, the edge whould be in contact with the sides at every point. In many cases overdevelopment of the shoulders or hams causes the appearance of a hollow behind the shoulder or in front of the ham. Uneven fattening may show wrinkles or depressions along the sides. The body should be thick and full at the flanks, this being an indication of good fattening power.

Skin and Hair.—Smoothness of the skin and fineness of the hair are two very desirable characteristics in the well-developed hog of any breed. By the packers the smooth, well-rounded skin is a desirable asset, as it increases the ease with which the carcass can be dressed and cleaned. In coarse-bred animals it is especially frequent to find deep wrinkles and creases in the skin of the face and sides.

The hair is another important point in passing judgment on the desirability of a hog. Those with coarse hair are usually poor breeders, and also do not show a good gain in weight in accordance with the grain that they eat. A fine, evenly distributed coat of hair usually indicates that the digestive apparatus is in good condition, and that they are good breeders and excellent fatteners. Color of hair and markings differ with each individual breed.

Tail.—This seemingly insignificant organ is of considerable importance in judging hogs of high quality. The tail should be not overly large, and should preferably be kinked or curled rather than carried straight. The point of attachment to the body is also of some importance. The tail should be attached to the body well up on the rump and not too low down. Too low attachment of the tail indicates too much slope of the rump and narrowing of space in the birth canal.

Carriage and Disposition.—To the expert judge of swine the carriage of the animal is a very important point in passing judg-

ment. The hog should stand firmly and yet easily upon all four feet. The pastern joints should be firm and well formed, the weight easily carried on the toes, and movement should be at once easy and graceful. When the hog moves, the hind feet should be carried forward in a straight line with those in front, and the gait should be easy and comfortable.

Disposition of the animal is also a very important point, from the standpoint both of breeding and of fattening. An irritable or vicious sow is never a good breeder. She is usually difficult to serve, hard to impregnate, and carries her litter poorly. At farrowing time she is hard to manage, and frequently will trample or viciously destroy her entire litter of pigs. This class of sows can never be used profitably in the breeding pens, regardless of how desirable they may be in other ways. For fattening purposes they are equally undesirable, as they keep up a continuous fighting with other animals in the feed lot, and in this manner not only keep themselves in poor condition, but prevent the proper development of other hogs as well. The desirable hog is one that has a quiet, docile disposition, and yet, at the same time, has sufficient motion and energy to get about and exercise sufficiently to maintain perfect health and proper function of the body. An overplethoric sow is usually a poor breeder, and, on account of being so lazy, does not give a nourishing milk, and digestive disorders in the litter are very common.

THE BACON TYPE OF HOG

In the export trade there is a constantly growing demand for a lean type of bacon. The fat sides of bacon produced by the lard type of hog, as represented by the Polands and Berkshires, do not meet with favor across the water. American packers, however, are loath to pay a higher price for this type of hogs, and this fact has in large measure prevented the development to any great extent of the bacon hog in this country, as the lard breeds are more rapid gainers in weight and show a better profit.

Bacon breeds are somewhat on the increase, however, and especially so in the Southern States, where an earnest effort is being made to build up the hog-producing industry. These bacon

breeds do especially well in the South, and are growing in popularity in that section steadily.

The main differences between the bacon breeds and the lard hogs are a longer head, longer legs, less width of back, longer and deeper sides, with less curve of rib and more lean meat, with correspondingly less fat. The bacon breeds, on account of their long legs, are more active and aggressive than the more steadfast lard breeds. In weight the bacon breeds run from 170 to 200 pounds. In Canada the lighter breeds are the more desired by breeders and packers.

Types.—The most representative breeds of the bacon type are the Tamworth, Large Yorkshire, and the Thin Rind, or Hampshire.

THE LARD TYPE OF HOG

THE POLAND-CHINA

This is the pioneer of all American breeds of swine. In fact, the most enthusiastic admirers of the Poland-China claim that it

Fig. 1.—Poland-China, packers' model: Farrowed, May, 1866. Weight, 806 pounds. Winner $700 Pork Packers' Prize at St. Louis in 1869. Society's sweep-stakes same time and place. Sweepstakes at Quincy, Ill., State Fair, 1868. Note spotted appearance.

is the *only* true American breed of hogs. Not only is the Poland the pioneer of American breeds, but it also is undoubtedly the most widely distributed of any single breed in American feed lots

to-day. Pure Poland-Chinas, and the various grade hogs derived by crossing the Poland with other types, forms by far the bulk of receipts at the great packing centers. This great popularity of the breed is, in large measure, due to the rapid maturity and excellent fattening qualities, which give favor in the eyes of the American farmer and stockman. Hog raising is a money-making business with the men who produce hogs in the Corn Belt, and a hog that has the rapid money-producing possibilities of the Poland-China is always bound to be popular.

Fig. 2.—Rood's giant: Weighed 1020 pounds. An excellent example of the big type of Poland-China. Owned by J. F. Cox & Sons, Keithsburg, Ill.

History.—There is no more interesting fact connected with the Poland-China breed than their early history. They had their origin in the United States, being developed by the Shakers in southwestern Ohio in the early part of the past century. The first reliable history of the breed dates back around 1812 or 1814. About this time the development of the breed that was to later become famous began in Warren and Butler counties, Ohio, and in Union and Wayne counties, Indiana. About this time there was a large colony of Shakers located in and around Union Village, Warren County, Ohio. These Shakers had at this time a large number of nondescript hogs, which were probably mostly of the

Russian and Byfield breeds. These hogs were not classified in any definite manner, and simply consisted of a large number of ordinary hogs. It was from this humble beginning that these breeders of the Miami Valley developed a breed of hogs that have set the standard for practically all breeds of the great American hog. It was indeed a wonderful accomplishment—starting with practically nothing, they bred up a standard type that was so entirely distinctive and unlike the European and Asiatic stock from which they sprang, as to be almost worthy of classification as a new species of animal rather than merely a new breed of the same species.

The origin of the name Poland-China is rather indefinite. The hog raisers of the Miami River Valley applied the name Poland, or Poland and China, to their hogs in the early 60's and perhaps even earlier. By some the name Poland is explained by the fact that one of these early founders of the breed came from Massachusetts, and brought with him a breed of swine that probably had their origin in Poland. This man was himself a Pole, and the hogs of his breeding probably got the name of Polands more from that fact than from direct importation from Poland.

Thorough investigation of this matter was made in the early 70's by the National Swine Breeders' Association, and the committee making the examination of existing records at that time reported that "in view of the difficulties in making a change in the name of any breed, that the said name of Poland-China be recognized as the accepted name of the breed." They reported, however, that they were unable to find any convincing proof of the Polish origin of the breed. No evidence has been advanced since this time to further prove the exact origin of the ancestry of the foundation stock.

No one man was sufficiently prominent in the early development of the new breed to be entitled to credit as being "the original Poland-China man." Mr. D. M. Magie and Mr. Ayers McCreary each claimed to have a pure-bred herd, consisting of Polands and Big Chinas. A. C. Moore, of Canton, Illinois, was another early claimant for this same honor. He had formerly lived in the Miami Valley, and he claimed that the herd he carried with him to his Illinois farm were pure Poland and Large China blood. Both Mr.

Moore and Mr. Magie were very active and enthusiastic admirers of the breed, and it is to their enthusiasm and energy that much of the early popularity and rapid improvement of the breed is due.

In the earliest breeding in Warren County the Russian and Byfield stock were crossed and also bred with other native hogs. For many years various names were applied to the swine which came from this district. Among other names used to designate these breeds were Magie, Butler County, Warren County, Miami Valley, Poland, Poland and China, Great Western, Shaker, Union Village, Dick's Creek, Gregory Creek, as well as many others. This haze of names goes to show what great confusion existed in this early development. It is the most wonderful achievement of the live-stock industry in the United States that these farmers were able to evolve from this greatly jumbled mixture a distinct breed of such excellence as that shown by the modern Poland-China, as seen in the Corn Belt feed lots to-day.

The advent of the Big China breed into the Miami Valley was about 1816. The first of these hogs to arrive in the district were brought by John Wallace from Philadelphia, who was a trustee of the Shaker Colony at Union Village. As has been already stated, it was to these Shakers around Union Village that the early improvement of the breed was due. One of the most interesting things about these Big China hogs is the fact that they were *white* in color, or white with sandy spots. The Russian and Byfield breeds were also white in color. From this it can be seen that the black color of the Poland-China is not developed as a characteristic of the early foundation stock, but is developed as a result of later crosses.

With the introduction of the Big China blood into the herds of Warren County there was a marked improvement in the character of the breed. These new animals were of superior quality, and were excellent feeders, hardy constitution, and prolific breeders. This strain became very favorably known throughout what was then known as the "Southwest" as the "Warren County Hog," and proved the source of a great boom to the swine industry of Ohio and Indiana in the period between 1816 and 1835.

In 1835 Munson Beach, of Lebanon, Warren County, Ohio, imported some Berkshire stock from New York State, and crossed

them with the then prevailing Warren County stock. The new Berkshire cross, by their greater size, stylish appearance, and powerful build, added greatly to the improvement of the native stock. Others soon followed suit, and for a number of years the Berkshires were extensively used as a cross for the Warren County herds. This developed a type which was more symmetric in appearance, perfected more quality, and had greater activity.

Most writers attribute to this Berkshire cross the development of the black color which is such an important prominent characteristic of the breed as it is known to-day. This is unquestionably an erroneous belief. In fact, it has been practically conclusively shown that these Berkshire hogs brought from New York State were not black hogs at all, but were red. Further than this, any of the older breeders of the Poland-China will bear witness to the fact that the development of the black-colored Poland-China did not take place until nearly fifty years later.

The Old Harkrader sow, which was one of the most prominent animals of the breed in 1870, was a pure white hog. The most noteworthy animals of the breed for twenty years after this date traced their ancestry to the Old Harkrader sow. She was by all means the most prominent animal of the breed, and lived practically fifty years after the change in color is generally supposed to have taken place. Other prominent Poland-Chinas of this date are described as white hogs, or white with some black points.

The true origin of the black color in the breed probably traces to the boar Tom Corwin. This animal was entered in the original Ohio Record Association herd book, and became one of the most famous animals of the breed. So great was the popularity of the get of this boar that it was only a few years until almost every prominent Poland-China herd traced their ancestry to the Corwin boar. This animal was nearly black, and was a very prepotent boar. His color was prominent in his get, and about this time breeders of the Poland began to select for breeding purposes those animals that were more black in color.

As late as the middle 80's show animals of the breed were spotted or even white in color, and it is only in the past twenty-five years that a truly black Poland-China breed has been de-

veloped, and this change in color is largely due to the popularity of the Corwin boar. For many years it has been more or less of an open secret among Poland-China breeders that the Corwin boar was not a full-blooded Poland-China. In fact, it is generally admitted that he was possessed of Berkshire blood, and it is due to this late cross with the Berkshire that the black color of the present-day Poland-China is due. This statement is distinctly at variance with the published histories of the breed, as set forth by other authorities, but coincides with the views of the leading breeders of the Poland to-day, and especially the older breeders, who can remember distinctly when the Poland-China was a white or spotted hog.

In the fall of 1839 William Neff, of Cincinnati, imported some hogs from Ireland which were known as Irish Graziers. These were crossed with the then prevailing breed, with marked improvement in style and grazing qualities, as well as hardiness and rapid maturity. This Irish Grazier stock merged with the hogs of the Miami Valley and became extinct in the early 40's, but not until it had had a most beneficial effect upon the development of the new breed which was destined to become the most popular in the United States.

Since that time the development of the breed has been largely through selection and careful breeding. The majority of authorities claim that there has been no new blood introduced into the Poland-China since 1845. With this statement I must beg to differ, as I think Berkshire blood was again brought in with the Corwin boar as above explained. With this exception, however, the breed of to-day is largely developed by careful selective breeding and elimination of the less desirable animals. There has been a steady improvement and increase in desirability of appearance, as can be seen by comparison of prize winners of 1866 and 1913.

Improvers of the Poland-China.—As already stated, no one man can claim the honor of being the originator of the Poland-China hog. Many men have come forth with the claim that they are the "original Poland-China man," but none have been able to offer convincing proof in substantiation of their claims. The Shakers of Union Village are undoubtedly the most worthy of

credit for bringing forth this breed. In their quiet, unassuming way they steadily blended the uncouth, rough-appearing breeds of these early days into a single smooth, elegant-appearing breed that was destined to set the standard to which all other breeds have aimed. The nearer they approach the Poland-China in general characteristics, the more American other breeds become, and the more popularity they gain with American farmers. This statement is not made with the idea of conveying the meaning that all other breeds are inferior to the Poland-China. Such is not the opinion of the writer. There are other breeds that carry perhaps nearly all of the good characteristics of the Poland and do not have his faults. The fact remains, however, that the Poland-China is the truly American type of hog, and the one from which other breeds cannot materially vary and obtain popular favor with the American farmer.

Poland-China Organizations.—In the interests of the breed, and for the purpose of adopting a uniform standard of type, a number of Poland-China Record Associations have been formed. The first of these was the Ohio Poland-China Record Association, which was organized at Dayton, Ohio, in 1878. This organization published the "Ohio Poland-China Record," the first issue of which was really published as a private enterprise in 1877 by Carl Friegau and M. J. Lawrence. The American Poland-China Record Association was organized about the same time at Cedar Rapids, Iowa. This organization published their first herd book in 1879 and have issued about sixty-five volumes since that time. In 1880, at Indianapolis, Ind., the Central Poland-China Record Association was started. Their first year-book was published the same year. The Northwestern Poland-China Record Association was organized at Washington, Kansas, in 1881. In 1887 the Standard Poland-China Association was organized at Marysville, Mo., publishing their first herd book that season. The spread of the Poland-China breed into southern territory led to the organization of the Southwestern Poland-China Record Association at Ripley, Tenn., in 1896. This organization was later taken over by the American Association. In 1905 the Ohio and Central Poland-China Associations were united to form the one organization under the name of the National Poland-China Record Associa-

tion. At the present time there are but three Poland-China Associations—viz., the American, the Standard, and the National.

Distribution of the Breed.—Without question, the Poland-China is the most widely distributed breed of hogs in America to-day. Their great superiority in numbers, as compared with other breeds, is not as marked to-day as it was twenty years ago. The Duroc-Jersey has rapidly come to the fore in the last two decades, and have forced the Poland-China out of many feed lots. They still possess an enormous following, however, and there are perhaps as many or more Poland-Chinas to-day as at any time in their history.

The breed is particularly popular through the great Corn Belt, and is to be found in the majority of feed lots in Ohio, Indiana, Illinois, Iowa, Nebraska, and Kansas. The great growth of the Poland-China industry in the western states is most interesting history. Forty years ago Ohio was the home of the breed, and any herd that could not boast of a herd leader that originated in Ohio was not worthy of notice. This led to a great demand for Ohio boars. The result was that the Ohio men sold all their best stock to western farmers, and it was not long until all the really good animals of the breed were to be found in Illinois and west of the Mississippi River. It was a hard pill for the Ohio men to swallow, but they were finally forced to go west and get breeding stock with which to build up their own depleted herds. Later on the Ohio herds again came into prominence, and became the source of valuable breeding stock. To-day, however, the most advanced improvement of the breed is taking place west of the Mississippi River, and the eastern breeders are again going west to find the most desirable breeding stock with which to head their herds. It is a conservative estimate to say that there are twenty-five Poland-China breeding hogs crossing the Mississippi River going east for one that is crossing the same line going west. The big Poland-China is decidedly a western product, and the eastern breeders are being forced to adopt this type or be left behind in the progress of their own breed.

This breed owes a great amount of its popularity to the fact that it was developed at a time when there was no real type of hogs suited to American environments. This breed, as finally developed,

is especially suited to conditions in the feed lots of the Corn Belt, and it is here that hogs are produced in greatest number. In Canada the Poland-China has not met with favor until the past decade. The great invasion of the western Canada provinces by American farmers has brought the breed into great prominence west of Winnipeg, and they are to-day winning the blue ribbons at many of the Dominion shows in the Canadian northwest. In Ontario and the provinces of eastern Canada the bacon type of hog is the favorite, and Polands are not seen to any great extent.

In the southern part of the United States the Poland is also largely produced. Particularly is this true in Texas, Tennessee, and Oklahoma. In Texas the Poland is particularly prominent, although the large type Poland is not as much in evidence there as in the Central West. In the southeastern states a movement is on foot to introduce more of the bacon type of hogs, but the Poland is to be found there in large numbers. In South America several shipments have been introduced from the United States, and the hog is proving well suited to conditions there. On the continent of Europe and in Great Britain the Poland is rather limited in distribution. Other types are more popular in these countries. Several shipments have been made to Australia, and have given quite uniform satisfaction in that country. Their principal home, however, is through the Corn Belt, and there they are to be seen by the million, either as pure bred Polands or crosses of Poland and other stock.

Leading Characteristics.—In the early development of the breed the Poland-China was a very large hog. Later in their development they became more finely molded and somewhat smaller in size. Ten years ago the Poland-Chinas had become considerably smaller than their original predecessors, although they still remained well above the average in size. About this time there developed in the western states a desire for a larger type of Poland. This desire has steadily grown until it may to-day be classed almost as a craze. At the fairs last year many Poland-China prize winners topped the scales at near or above 1000 pounds. This large type Poland-China is especially a western product, and is not so much in evidence in Ohio and Indiana. In those states, however, the breeders are awakening to the fact that they must develop a larger hog or

be left behind in the march of progress. They are, accordingly, going west in large numbers to purchase breeding stock of this larger type.

There would seem to be just cause to sound a word of warning in this respect, lest the craze for a large hog be carried to such an extreme as to result in eliminating many of the valuable characteristics of the breed which have made it the most popular of all American swine breeds for the past three-quarters of a century. Early maturity has long been one of the most commendable qualities of the Poland-China. It is doubtful if any other breed will

Fig. 3.—Poland-China: A double 1913 champion; weight, 765 pounds.

finish off as quickly or as easily as the Poland-China. This is especially true when placed on full feed of corn. This is a quality that has long made them popular with farmer and packer alike, and it would be regretable if this excellent characteristic should be lost through the overdeveloped desire for a large hog type.

This breed is an easy keeper and a good feeder. The cross with Irish Graziers in the late 30's imparted to this breed excellent grazing qualities, and they thrive well on an open pasture as well as in close feed lots. They do especially well on the low-lying pastures of the Corn Belt. On the rough hilly fields of the eastern United States and New England this breed does not do so well.

They show excellent returns for a comparatively small amount of care and a very moderate amount of feed. Perhaps no other large breed shows as much return for the money put in them as does the Poland-China. This breed also shows a very small shrinkage between feed lot and killing floor. This makes them especially popular with western shippers, who must take their hogs long distances to get them to the large markets.

The packers like the Poland-China because they dress out well, are easy to clean, and have a comparatively small percentage of offal. The meat is fine in grain and tender, but has the one ob-

Fig. 4.—Poland-China: A three-times champion of 1913.

jection, that it contains a relatively large amount of fat. This interferes with the value of the bacon. This is in a measure explained by the fact that the hog is usually allowed to reach extreme size before being marketed. If the Poland-China were sent to market at bacon weight there would be a marked improvement in quality of the bacon. The Poland-China is, however, pre-eminently a lard hog, and producers of the breed should leave the bacon field to other breeds more suited to bacon production. This lack of bacon-producing qualities explains the comparative unpopularity of the Poland-China in eastern Canada, Europe, and some of the northern and eastern states of this country.

The Poland-China hog has one great advantage over the white breeds, and especially the Chester-White, in that it is practically free from the disagreeable skin diseases which so often attack the white hogs.

Question of Small Litters.—This is the principal argument that has been offered against the Poland-China. In some respects the claim of small litters seems to be substantiated by facts. However, an investigation by the United States Government, made a few years ago, showed that the number of pigs per litter of the Poland-China breed was on the increase rather than the decrease. The conditions under which the hog is kept in the Corn Belt probably in large measure accounts for lack of prolific litters on the part of not only the Poland-China but other breeds as well. The change is more noticeable in the Poland-China, because they have been longest kept under these conditions. In the average Corn Belt feed lot hogs are fed for the purpose of putting on fat, and very little encouragement is offered to exercise. This has a tendency to cut down the breeding qualities, and it is a question whether other breeds will not show a like lack of prolific breeding qualities after they have become used to these same conditions.

This argument of poor breeding quality has been used very aggressively against the Poland-China by advocates of other types, but has probably been somewhat overdrawn by enthusiastic promoters of new breeds.

As a cross-breeder the Poland-China is an excellent animal. They cross especially well with the ordinary grade sow seen in the Central West, and produce offspring which is compact in form, matures early, and shows excellent outline and unexcelled fattening powers. They also cross well with pure-bred hogs of other breeds, but perhaps not as successfully as in crosses with the grade animals.

CHESTER-WHITES

This is also a purely American breed of swine. The origin of the Chester-Whites is Chester and Delaware counties in Pennsylvania. Previous to 1820 the breeders of this part of Pennsylvania had been raising for a number of years a large, coarse breed of hogs, which were white in color and which formed the basis for development of the Chester-White breed of to-day. These hogs

were a coarse-grained, heavy type, and their origin is generally believed to have been hogs brought over from England with the original colonists of William Penn.

In the year 1820 Captain James Jeffries, of Westchester, brought over from England a boar. This animal came from the neighborhood of Bedford, England, and the breed of which he was a type was referred to as the Bedfordshire. This animal was also a white hog, but was of a more refined type than the native Chester hogs already mentioned. The crossing of this boar with his regular herd produced for Captain Jeffries a strain of hogs that possessed all the good qualities of the native stock, but had an added refinement and smoothness which gave them a material improvement in general appearance.

Some few years later a Mr. Harvey Atwood, of Delaware County, Pa., imported some Chinese hogs from England, and mixed them with his native stock. He also purchased some hogs from the farm of Captain Jeffries, and the blending of these two improved herds formed the actual start of the Chester-White breed.

Improved Chester-Whites.—While the origin of the Chester-White breed is Chester County, Pa., the improvement of the strain has been largely carried on in Ohio. In 1830 Isaac and Kneeland Todd moved to northern Ohio from the state of Connecticut. They had long been breeders of fancy hogs in the Nutmeg State, and when they came west they brought with them some of this fancy stock. These swine, brought from the New England fields by the Todd brothers, were developed from the Irish Grazier and Norfolk Thin Rind breeds.

Three years later Joseph Haskins moved from the state of Massachusetts to Ohio. He also was a breeder of fancy hogs. He brought with him stock which was a cross of the Byfield breed and Thin Rind strain. Naturally, Haskins and Todd, being pioneers in this territory, bred back and forth. The result was the development of a most showy type of hogs. The strain was further added to by the Todd family a few years later by the introduction of a boar from what was known as the Large Grass breed. This animal was obtained from Joel Meade, of Norwalk, Ohio, and added materially to the grazing qualities of the stock. In 1862 a

new boar was added, known as a Normandy hog. This breed was of a somewhat unknown strain, but probably of French origin. Todd became famous as a breeder and exhibitor of fancy hogs, and at the early meetings of the Ohio State Fair in the 60's his pens were decorated with the blue ribbons.

About this time he became interested in the Pennsylvania swine, and some Chester-White blood was imported from the vicinity of Westchester. A little later his son assumed active management of the farm, and more Chester-White stock was added to the breeding pens. For nearly half a century this family devoted itself to the upbuilding and popularizing of the Chester-White

Fig. 3. Excellent type of Chester-White boar. (Photo loaned by "White Breeders' Companion.")

animal, and they are unquestionably among the foremost improvers of the breed, an honor which they share with Thomas Wood, of Chester County, Pa.

Owing to the fact that the pure-bred Chester-White hog often shows a few black markings, the claim has been repeatedly made that Poland-China stock has entered into the development of the breed. Odds has been added to this claim also by the fact that Ohio is the state in which the Poland-China hog has been developed. Mr. Todd absolutely denies this fact, however, and declares that Poland-China blood has never been used to cross the breed as developed by him. The explanation of the black markings

found on the Chester-White is that it is the result of the original cross with the Thin Rind hogs by his father while developing the herd in Connecticut. These Thin Rind hogs were black, spotted with white, or white belted with black.

Characteristics of the Breed.—The Chester-White breed, as originally developed in Chester County, Pa., was a very large, coarse white hog. In these early herds it was not unusual to have an animal that would weigh 1000 pounds. Breeding and crossing with smaller and more refined breeds have led to some changes in

Fig. 6.—Iowa Delight, No. 45,936. Chester-White Record. Champion sow S. D. and Neb. State Fairs; also Interstate Fair, St. Joseph, Mo., 1913. Owned by Thos. F. Kent, Walnut, Iowa. (Photo loaned by "White Breeders' Companion.")

the type and size of animal. The Chester-White of to-day, however, is among the largest of all the lard types, and the full-grown animal will average in the neighborhood of 650 pounds.

The hair of the Chester-White hog tends to be somewhat coarse in appearance, white in color, and shows a varying tendency to curliness. In the hot low-lying pastures of the Middle West the skin of the Chester-White shows a tendency to burn, and, as a result, may appear dirty and scurfy. This predisposes the animal to the development of mange, and is one of the reasons for retarding the spread of the breed in the Corn Belt states.

Chester-White hogs are excellent breeders, producing a larger litter, and carrying a larger percentage to maturity than do the Berkshire, Poland-China, or Duroc-Jersey. They also show an early maturity, and are excellent feeders and rangers. It has been estimated that the Chester-White will show an average gain under good conditions of 1 pound in weight for every 3 pounds of feed given. This is an excellent showing, and one worthy of consideration by the feeder.

Distribution of the Chester-White is fairly widespread, but for some reason they have never acquired the popularity enjoyed

Fig. 7.—Group of Chester-Whites. Show exhibit of F. E. Bone, Ava, Ill. (Loaned by "White Breeders' Companion.")

by the Poland-China, Berkshire, and, of late, by the Duroc-Jersey. There are a number of reasons for this, one of the most important of which is the fact that in the early days of the popularity of the Chester-White a great deal of fraud was practised by unscrupulous dealers. The demand for the white hog became so large that the regular breeders were unable to supply it, and fakirs in various parts of the country began to advertise and sell what they called Chester-Whites, and which, in reality, were only a coarse type of native white hogs. These animals proved unsattisfactory, and disgusted many sections of the country with the breed. The tendency to mange, and the scurfy appearance of

the skin as a result, has been a large factor in destroying their popularity among the large farmers of the Middle West. Record prices for the hogs of this breed have never approached those quoted for the Poland-China and Berkshire breeds. Fifty to one hundred dollars is about the top price for hogs of this breed. The world champion boar at the Chicago World's Fair sold for the meager sum of $150, which was a record price at that time.

Standard Points.—The *head* of the Chester-White hog shows a straight face, somewhat like that seen in the Poland-China, but slightly more dished. The *nose* has a tendency to be rather long

Fig. 8.—Kent's kind, No. 48,888. Chester-White Record: Champion sow at five state fairs, 1912; five state fairs, 1913. Owned by Thomas F. Kent, Walnut, Iowa. (Photo loaned by "White Breeders' Companion.")

and narrow. The *ears* are large, rather coarse, and droop for the anterior one-third or even one-half. The *eyes* are large, bright, wide set, and should not be surrounded by ridges of fat or wrinkles of skin.

The *neck* and *jowl* are full and well fleshed. The *shoulders* well proportioned, full, and merge gracefully with neck and body. The *body* is long and of good depth. *Chest* wide and long, showing excellent capacity for lungs and heart. The long, deep abdomen gives excellent accommodation for digestive organs and ample space for breeding purposes. The *back* is long and gently arched. *Loins*

are wide and well covered with fat. The *ribs* are long, flat, and well sprung, giving excellent proportions for development of flesh and fat.

When the *legs* of the Chester-White hog are examined they are found to present the main point of weakness of the breed. The limbs are fairly long, rather heavy boned, but are a little weak at the *pasterns*. The toes are poorly placed, being rather wide spread, and with the dew claws set rather too low. The *pastern joints* are inclined to be weak, as compared with the rapid development and heavy weight of the breed. This gives a tendency to break down under the strain of full flesh. This is about the only serious defect of the breed, but is an important one from the standpoint of the feeder. This objection is largely eliminated by crossing the breed with other types that have a somewhat finer bone and a better developed pastern.

In *disposition* the Chester-White is very quiet and easy to manage. This, in large measure, explains the excellent breeding and feeding qualities. In movement the hogs of this type are graceful and yet fairly active. They are good grazers, and do well on pasture lands, as also in the feed lot and stye.

Chester-White hogs produce a very fair type of pork, but it has the same objections as that of any of the lard type of swine, in that it carries a large amount of fat as compared with the amount of flesh. This makes a bacon which does not meet with favor in the export trade.

This breed has been markedly increasing in popularity in the past ten years, and is an ever-increasing factor at the fair exhibits. The excellent breeding qualities and the remarkable early maturity and excellent fattening possibilities of the breed entitle it to a much larger distribution. The hog is more of a favorite perhaps in the eastern states than in the Corn Belt, where its popularity is now on the increase.

Cross-breeding of the Chester-White with other breeds shows excellent results. Especially is this the case when crossed with the Poland-China or Berkshire breeds, or with grade sows derived from either of these breeds. In this manner the coarser qualities of the Chester-White are in part toned down, and the strength of the pasterns improved.

Chester-White Associations.—There are a number of associations formed for the purpose of improving and promoting the interests of the Chester-White breed. Important among these are the American Chester-White Record Association, the Ohio Improved Chester-White Swine Breeders' Association, the Standard Chester-White Record Association, and the National Chester-White Record Association.

O. I. C. BREED

This is a breed of swine which is officially known as the Ohio Improved Chesters, but more commonly under the letters O. I. C.

Fig. 9.—Champion "Bright Eyes," No. 30,433, vol. 13, O. I. C. Record also 19,779, vol. 15, C. W. Record. (Sired by Jem's Dandy, 15,627, C. W. Record.)

The breed is, in reality, an outgrowth from the Chester-White type. The early history of the breed is that of the white hog of Chester County, Pa. The actual development of the O. I. C. type took place, however, in northern Ohio. About 1865 the late L. B. Silver, at that time a prominent swine breeder of Ohio, became disgusted with the white hogs then on the market in his own state, and made a personal trip to Chester County for the purpose of procuring some No. 1 breeding stock.

He visited all the leading swine raisers of Chester County, and purchased a number of the best specimens of the Chester County

hog obtainable. These he took home with him to Ohio and placed in his breeding pens. No cross was made with any other type, and simply by careful breeding, and common sense weeding out of the undesirable pigs in each litter, he built up a strain of white hogs which were of such an improved nature as to be practically entitled to classification as a separate family.

The Ohio Improved Chester-White is a very large hog, of the lard type, often weighing over 1000 pounds. "Curly Boy," one of the famous boars of this breed, reached the enormous weight of 1255 pounds. The head is somewhat similar to that of the Chester-White, but a little more refined in appearance. The ears are large,

Fig. 10. "Fairland Cora," O. I. C. Record No. 27,196, vol. 13. Owned by F. J. Wade, Weston, Ohio.

and have a tendency to drop over in the anterior third. The neck is full, deep, and well arched. The body of the O. I. C. is unusually long and deep, making for great weight-carrying possibilities, and at the same time giving ample room for digestive and pelvic organs. This in a measure explains the great prolificacy of the breed. The ribs are broad, long, and well sprung, giving plenty of room for carrying a large volume of fat and meat. The broad, deep chest also speaks well for a roomy breathing apparatus and vigorous health. The back is long, broad, and slightly arched. Hams and shoulders are unusually heavy and well fleshed. The legs are of medium length, heavy boned, and have a powerful, well-formed foot. This sustains well the weight of the animal, and also gives

excellent power of locomotion. The O. I. C. is a good forager and a good feeder. The admirers of the breed claim that they are an easy keeper and one of the best fatteners.

The color of the breed is white. The hair is rather long, slightly coarse, and shows a tendency to curl. Blue pigmented spots in the skin are permissible, but black hair is objectionable and disqualifies. In disposition the O. I. C. is a quiet, gentle animal, and this is a most valuable characteristic from the standpoint of breeding. The sows are good mothers, nurse their litter well, and bring a large percentage of them to maturity. Large litters is the rule with the O. I. C. breed. The gilts often bring eight to ten pigs, and the older sows, ten to twelve. They cross well with other breeds and impart their desirable qualities to a marked degree.

In the show ring the record of the O. I. C. is a pleasing one to the admirers of the breed. At the Louisiana Purchase Exposition in St. Louis the Grand Champion Boar of any age was an O. I. C., "Jackson Chief," 4759, and at the Alaska-Yukon Exposition the Grand Champion Boar and the Grand Champion Sow were both O. I. C.'s.

The same unscrupulous tactics that ruined the Chester-White popularity have done a great injury to the O. I. C. About forty years ago, when there was such an enormous demand through the Central West for the Chester County white hog, these dishonest dealers in Chester County went around over Chester and adjoining counties and bought up every white hog they could find, regardless of whether they were grade or pure-bred stock. These were sold and shipped all over the country as pure-bred Chester County Whites. Being poor quality stuff and mostly grades, they did not breed true to type or form, and, as a result, hog raisers became disgusted not only with the Chester-White, but with all white hogs. This has in large measure retarded the progress of the O. I. C. breed, but they are gradually coming into their own, and are appearing each year at a larger number of the state and local exhibitions. The hog is a massive, well-appearing animal, and one that deserves wider popularity than they now enjoy. Recent improvers of the breed are located principally in Ohio and Illinois. A. M. Foster, of Rushville, Ill., is now one of the leading breeders

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Some few years later a Mr. Harvey Atwood, of Delaware County, Pa., imported some Chinese hogs from England, and mixed them with his native stock. He also purchased some hogs from the farm of Captain Jeffries, and the blending of these two improved herds formed the actual start of the Chester-White breed.

Improved Chester-Whites.—While the origin of the Chester-White breed is Chester County, Pa., the improvement of the strain has been largely carried on in Ohio. In 1830 Isaac and Kneeland Todd moved to northern Ohio from the state of Connecticut. They had long been breeders of fancy hogs in the Nutmeg State, and when they came west they brought with them some of this fancy stock. These swine, brought from the New England fields by the Todd brothers, were developed from the Irish Grazier and Norfolk Thin Rind breeds.

Three years later Joseph Haskins moved from the state of Massachusetts to Ohio. He also was a breeder of fancy hogs. He brought with him stock which was a cross of the Byfield breed and Thin Rind strain. Naturally, Haskins and Todd, being pioneers in this territory, bred back and forth. The result was the development of a most showy type of hogs. The strain was further added to by the Todd family a few years later by the introduction of a boar from what was known as the Large Grass breed. This animal was obtained from Joel Meade, of Norwalk, Ohio, and added materially to the grazing qualities of the stock. In 1862 a

Saratoga and also in Washington County, New York, began the interbreeding of these various types of red hogs. Some of the New Jersey stock was also brought in, and the result was an amalgamation of the Duroc of New York, the Red Berkshires of Connecticut, the Large Jersey Red of New Jersey, and perhaps also the Red Rocks of Vermont, to form a more or less uniform breed, known under the compound name of Duroc-Jersey, in honor of the sources of the two principal breeds entering into the combination.

Under the able direction of Colonel F. D. Curtis the breeders of Saratoga and Washington counties formed an organization in 1877 for the purpose of promoting uniformity in standards and

Fig. 11.—Grand Champion Duroc Barrow, 1913, International. Owned by Thomas Johnson, Columbus, Ohio. (Photo loaned by Robert J. Evans.)

excellence in type. This organization received able co-operation from the breeders of the Red Berkshire and Red Rock types, and the result was the evolving of a standard breed of red hogs under the name of Duroc-Jerseys. At this time the red hog was a very large type, coarse, heavy boned, and far less symmetric and refined in appearance than the Duroc-Jersey of to-day. The efforts of these early developers of the breed was to encourage refinement, with decrease, if necessary, in weight.

Colonel F. D. Curtis, of New York, was the master spirit in the development of the Duroc-Jersey breed. He was a very capable breeder and a mover among men. Under his able leadership the

breed was wonderfully developed and its popularity became widespread. Other prominent promoters of the red hog at this time were William H. Holmes, of New York; S. E. Morton, of Ohio; Thomas Bennett, J. M. Stonebraker, and George W. Stoner, of Illinois; William Roberts, of Iowa, and C. H. Searle, of Nebraska.

General Characteristics.—The Duroc-Jersey is a medium-sized red hog. The fully developed animals weigh in the neighborhood of 500 and 600 pounds, while many of the large type of this breed have scaled as high as 1000 pounds. In the past twenty-five years the size of the Duroc has considerably decreased, owing to the efforts of breeders to produce a smaller, finer-grained animal.

Fig. 12.—"Maud Irene III." Grand Champion Sow, Indiana, 1912. Owned by Mahan Bros. (Photo loaned by Robert J. Evans.)

In comparison with the size of the animal the head of the Duroc-Jersey might be classed as small. The face inclines to the straight rather than the dished type. The snout is moderately long and well fleshed. The ears are of medium size, inclined to be moderately thin, and point forward, downward, and slightly upward. In older animals they break over in the anterior third or half and droop downward.

In the Duroc-Jersey the neck is short, heavy, and well arched. The jowl is full, firm, and fleshy, carrying the fulness well back to the point of the shoulder. The shoulders are moderately heavy

and very deep. They blend neatly with neck and body and give a symmetric appearance to the anterior portion of the body. The back is broad and moderately long. It may be straight or even slightly arched. The width is well carried and evenly proportioned from shoulder to ham. The hams are full, rounded, heavy, and the flesh is carried well down to the hock.

The sides are of medium length, but are very deep and well fleshed. The ribs are long, wide, and well sprung in proportion to the other parts of the body. The legs are of medium length, well

Fig. 13.—Robert's model. First prize aged sow, Iowa State Fair, 1913. Sired by "Chief's Protection." Bred and owned by R. J. Harding, Macedonia, Ia. (Photo loaned by Robert J. Evans.)

boned, and with strong pasterns. Recent breeding for the purpose of producing a small and finer type of Duroc has tended to weaken the legs of this animal. The old Jersey Red had a very powerful limb, but this is only partly preserved in the present representatives of the breed.

Cherry Red Color.—The color of this breed is preferably a cherry red. Other shades of red or even brown are common. Dark colored spots over the body are objectionable. Black spots on the belly and legs are not desirable, but do not disqualify the animal. As a feeder and grazer the Duroc compares favorably

with the other widely distributed breeds. The animal does well under the conditions prevailing in the feed lots of the Corn Belt and also does well on clover and blue-grass pastures. Many experiments at state agricultural colleges show, however, that the cost of fattening in the Duroc-Jersey is slightly higher than in the other commonly raised breeds. Also on the killing floor the percentage of offal is slightly higher than in other lard types.

Prolific Breeder.—In the matter of breeding the Duroc-Jersey is one of the most prolific of all breeds. Litters of 10 and 12 pigs, and even as high as 15 to 18, are common with sows of this breed. This marked reproductive power has done a great

Fig. 14.—Group of Duroc-Jersey barrows shown by University of Missouri at 1913 International. (Photo loaned by Robert J. Evans.)

deal in increasing the popularity of the Durocs with Central West feeders. This is one of the main drawbacks of the Poland-China. In many instances the Duroc-Jersey is crowding out the Polands on account of their more prolific breeding qualities. When crossed with other breeds the Duroc also does well, and establishes a strong vigorous type which possesses excellent reproductive powers.

Official Associations.—For many years the distribution of the Duroc-Jersey was largely limited to New York, New Jersey, and the South Atlantic States. In recent years it has been introduced extensively into the Corn Belt States, and is now a very popular

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hog in Illinois, Indiana, Ohio, Iowa, and other states of the Middle West. The promotion of the interests of the breed is looked after by two very powerful associations, known as the National and the American.

As a utility animal the Duroc enthusiasts believe that they have a breed which has no superiors. The leading idea in the minds of the promoters of this breed has been to develop an animal that for pork utility will have the highest degree of excellence, regardless of mere physical beauty. One of the leading Duroc breeders, when quoted on this subject, states that, "After all, beauty and fancy notions are not equal in importance to profit."

The foraging qualities of the Durocs make them popular hogs in the South and Southwest, where they are rapidly growing in number. On the Pacific coast also the red hog is high in public favor. Their easy-keeping qualities and the prolific litters offer opportunities for maximum profit that are probably not surpassed by any other breed. The Duroc has been energetically pushed for only a comparatively few years, and the rapid gain in popular favor has been the wonder of the pork-producing world. Literally speaking, the breed has "made a hog of itself."

THE BERKSHIRE

The counties of Berkshire and Wilts, in the south-central part of England, are the home of the Berkshire hog, which is one of the most widely distributed breeds in the United States to-day. This breed has long been a favorite with American swine owners, and it is a close candidate for popularity with the best of the native American breeds, such as the Poland-China and Chester-Whites. The name of the breed, as might easily be divined, is derived from the name of the county in which the type was most prominently developed.

Early History.—Berkshires are among the earliest of English breeds, and were well known even before the year 1800. At this early date the hog was reddish-brown in color and of enormous size, it being common to meet examples of the breed that weighed over 1000 pounds. Young, a writer of that period, refers to one hog of the Berkshire strain that weighed 1130 pounds.

Like other native breeds of England, the Berkshire was about

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this time crossed with Chinese and Siamese blood, and also probably with some of the Neapolitian blood introduced into England about the commencement of the last century from Italy. These crosses in the breed resulted in decreasing the weight, and produced a type of smaller size and finer bone than the original Berkshire. As writers disagree on the characteristics of this early period, it would seem that no definite standard was in force at that time.

In the early part of the 18th century the most prominent breeders of the Berkshire type were Lord Barrington and Mr. Richard Astley. Later in the century many breeders of central England

Fig. 15.—Model Duke, No. 17,397, at six years and eight months. Sold for $750. Note "six white points."

became interested in the development of the Berkshire, and kept up the improvement of the breed.

Prominent Breeders.—Importation into the United States was first made in 1823 by John Brentnall, of New Jersey. Sidney Hawes arrived from England in 1832 and settled near Albany, N. Y. He brought over with him a number of Berkshire hogs. A large importation was made from England in 1839 to Orange County, N. Y., by two English farmers of that county, named Bagg and Wait. These hogs were afterward sold largely to breeders in Ohio, Kentucky, and Tennessee. Among the more important breeders of the Berkshire in recent years are N. H. Gentry, of

Sedalia, Mo., whose herd is perhaps the leading one in the United States. This herd was for years headed by "Longfellow," the greatest boar the Berkshire breed has ever known. A. L. Lovejoy, of Illinois, M. K. Prine, of Iowa, and James Riley and I. N. Barker, of Indiana, have also been prominent breeders of this type of swine.

At the present time the Berkshire breed is very widely distributed over the United States. It is also quite prominent in European countries, particularly in England, Ireland, the continent of Europe, and also in Australia and Canada. In the United States there are few, if any, breeds that are more widely known. Berkshire herds may be found in almost every state, and particularly in New York, Ohio, Illinois, Indiana, Missouri, Iowa, Pennsylvania, Michigan, and Wisconsin.

Fig. 16.—Baron Premier 84th—an excellent type of Berkshire boar. Owned by N. H. Gentry, Sedalia, Mo.

General Characteristics.—The Berkshire is a large black hog, with a white stripe on the forehead, white tip to the tail, and four white feet. The spots of white just mentioned are known among Berkshire fanciers as the "six white points." Swine of this breed are very stylish appearing, symmetric, massive, and at the same time alert and graceful, combining freedom of motion with grace and elegance.

Long, Moderately Broad Hog.—The head of the Berkshire is of medium size. The face shows a well-marked dishing and a white stripe down the forehead. The snout is rather short, broad, and may be slightly upturned. The animal shows a good breadth between the eyes. The ears are large and erect or slightly pointed forward. There may be some drooping in the older animals.

The neck is full, broad on top, and blends comfortably with head and shoulders. Jowls are meaty, but firm and neat. The shoulders and hams are not overly large and moderately fleshed. The back and sides are long, the back being fairly broad, although not as much so as in the Poland-China. There is less tendency to arching of the back in the Berkshire than in the Poland-China. The loins are in proportion to the back and the tail attaches rather high. Ribs are long, wide, and well sprung. The legs are of moderate length, although there is a slight tendency in some herds

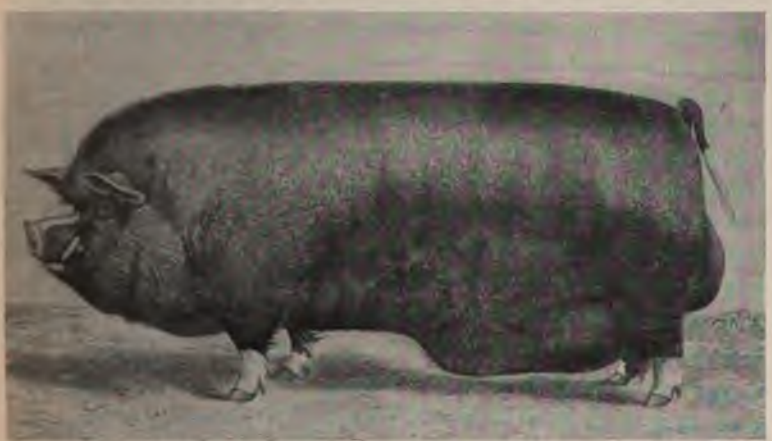

Fig. 17.—"Longfellow," No. 16,835, the greatest of living Berkshire sires at five and one-half years of age. Weight at five days under seventeen months old, 726 pounds. Winner of class and sweepstakes prizes for two years in succession at the Great St. Louis and other Western State Fairs. Bred by N. H. Gentry, Sedalia, Mo.

to an overlength of legs. The bone is of good form and the animal makes a good grazer and stands well under heavy weight.

Good Breeders.—The Berkshire makes an excellent grazer, owing to the comparatively long and powerful limbs. The breed also shows a great amount of adaptability to different surroundings, being found to do well in the northern states and also in the warmer climate of the South. The Berkshire does well on open pastures or in the feed lot. As a breeder they are quite prolific, and produce a large litter which is well nursed and suckled. The breed is a good feeder and a good fattener, although perhaps not finishing off as rapidly as the Poland-China. Berkshires produce an excel-

lent quality of pork, which contains a fair proportion of lean meat. They cross well with other breeds, and impart size, freedom of movement, and improved breeding qualities to the animals of the smaller breeds.

The most important **Berkshire Association** in the United States is the American Berkshire Record Association, which has its headquarters at Springfield, Ill.

MULEFOOT HOG

This is one of the most interesting of all the breeds of swine, especially to those who are inclined to consideration of the unusual. The great distinguishing point with regard to this breed is the solid hoof, rather than the split or cloven hoof as seen in all other breeds. The Mulefoot hog also at one time enjoyed another peculiar distinction, which has since been discarded. The hog appears to have in many instances something akin to partial immunity against cholera. A number of years ago, when this fact was first noted, a number of overenthusiastic admirers of the breed began to advertise the Mulefoot as hog-cholera proof. This claim was not founded on a sufficient amount of actual tests, and it has since been found that the Mulefoot is just as susceptible perhaps as the other breeds.

Fig. 18.—Hoof of Mulefoot.

It was a very unfortunate thing for the Mulefoot hog that it was popularized along this line, for when it became definitely proved that such was not the case, the main support of the breed in the eyes of the farmer was removed, and for a number of years Mulefoots were in very poor demand. They are now coming to the fore again from the standpoint of actual merit as breeders, grazers, and feeders, and are taking their proper place in the fore ranks of American swine.

The early history of the Mulefoot hog is somewhat of an unwritten book. The investigators of the early history of swine trace mention of the Mulefoot back even to the time of the Greek philosopher Aristotle, who mentions the solid-hoofed hog in his writings.

Other mention has been made in ancient works of a breed of hogs that was undoubtedly the Mulefoot.

The first importations of the breed into the United States probably came with slave ships plying from the coast of Africa. The breed at least reached our shores in some manner, and became established in the feed lots of Virginia, Pennsylvania, Ohio, Illinois, Indiana, Kentucky, and Missouri before the Civil War.

Ohio, Missouri, and Indiana appear to have been especially the home of breeders with whom this hog is a favorite. Mr. John H. Dunlap, of Williamsport, Ohio, is at present one of the largest breeders of the Mulefoot hog. This man has developed

Fig. 19.—"Goliath," No. 5001. A 900-pound Mulefoot hog. Owned by John H. Dunlap, Williamsport, Ohio.

some of the grandest specimens of the breed ever shown, and is one of the most aggressive advocates of the breed. The Mulefoot is a breed that has apparently been developed almost entirely through selection. There has been little or no crossing with other breeds, and the Mulefoot of to-day is the Mulefoot of ages ago.

General Characteristics of the Breed.—The Mulefoot is a large black hog. The best specimens are completely black, although a few white spots are permissible. The hog is a fairly large type, and animals weighing 500 to 600 pounds are common. Some have scaled as high as 1000 pounds. On an average, the breed is a little smaller than the other lard-type breeds.

The head is of medium size and rather bear appearance, with a [illegible] bright eye, bear looking ears, and full,

Fig. 20.—Grand champion Mulefoot boar. Owned by John H. Dunlap, Williamsport, Ohio.

Fig. 21.—First prize boar at State Fairs. Largest living Mulefoot. Owned by John H. Dunlap, Williamsport, Ohio.

firm jowls. The neck is full, nicely arched, and merges neatly with head and shoulders. The shoulders are well fleshed and give

excellent appearance to the anterior portion of the body. The body is inclined to be lengthy and deep, a combination which gives the animal greater weight than one would judge from a rough estimation based on the size of the hog.

Prolific Breeders.—As a feeder the Mulefoot compares excellently with all other breeds, and many advocates of the breed claim that they fatten even better than most of the lard types. In any case, they are a breed that will show excellent returns on the feed

Fig. 22.—Feet of Mulefoot hog. (Photo loaned by G. E. Kreglow, Ada, Ohio.)

put into them. As a breeder they certainly excel many of the more stocky built breeds. The length and depth of body give plenty of room for development of the pelvic organs, and, as a result, large litters of Mulefoot pigs are the rule rather than the exception. The mothers are nearly always docile, good milkers, take good care of their young, and bring a large percentage of them to weaning time.

Peculiar Foot.—The feet of the Mulefoot hog are its most interesting characteristic. The legs themselves are of medium length,

and placed well apart under the body. They are well boned, have firm pastern joints, and sustain well the weight of the animal. The legs are also built for grazing, and this enables the hog to do well as a forager. The special peculiarity of the Mulefoot hog is the foot. In all other breeds of swine the foot is cloven in appearance. In the Mulefoot there is not this separation into two lateral halves or toes. Instead, the entire hoof is solid, and there is not a sign of a crease or crack. The dew claws of the Mulefoot hog are also a little longer, and are placed a little lower down on the foot than in other breeds. When the Mulefoot is crossed on other strains it imparts its strong qualities to a marked degree, and makes an

Fig. 23.—Prize-winning Mulefoot sow and litter of pigs. Owned and bred by John H. Dunlap, Williamsport, Ohio.

excellent cross with some of the less active and less prolific of the lard types. The solid hoof is shown, as a rule, in the litters obtained by these crosses of the Mulefoot with grade or other pure-bred stock. Owing to the fact that it has never been cross-bred to any extent with other types, the Mulefoot possesses unusual breeding strength, and carries over its qualities to the offspring in unusual degree.

Coming to Front.—The Mulefoot hog, when all is considered, appears to be a very worthy example of the lard types. He is a hardy animal, and, while his reputation was to some degree injured by early claims with regard to cholera, the breed is now forging to the front. The breeders of this type are now organized under the

name of the American Mulefoot Hog Record Association, of which Mr. Dunlap, of Williamsport, Ohio, is President. Under the direction and leadership of this able breeder the association has accomplished a great amount of work in promoting the interest of the breed. Mr. Kreglow, of Ada, Ohio, is secretary of this same association, and a well-known breeder of the Mulefoot type of swine.

To both of these gentlemen, and especially to Mr. Dunlap, I am endebted for much willing assistance in securing the early history and some excellent photographs of the breed.

THE BACON TYPE OF HOG

TAMWORTH

This breed came originally from England. The counties of Stafford, Liecester, Southampton, and Warwick are the home of the early Tamworths. The breed takes its name from the town

Fig. 24.—Mt. Horne Golden Star. Winner of many first prizes and championships at the leading fairs. Property of Oak Ridge Farm, Oak Ridge, Va. (Photo loaned by C. H. Yates, Mgr.)

of Tamworth, in South Staffordshire, where the breed was at one time especially common.

History.—The early history of the Tamworth is somewhat indefinite. It has been claimed that the breed is one of the oldest

in the British Islands, and the Tamworth hog is believed to have run wild in the Stafford woods for years. It has been claimed, also, that the first swine of this type were imported from Ireland by Sir Robert Pell, about 1812. This statement does not seem to be substantiated by any official records.

In the early part of the last century the Tamworth was a very rough, long-legged, narrow-backed, long-nosed, red hog, noted for its long, narrow body, slow maturing qualities, activity, and hardiness. Improvement in the breed appears to have been by selective breeding, rather than due to crossing of the Tamworth with other

Fig. 25.—"Oak Ridge Chief II." Winner of first prize at Virginia State Fair, 1913. Property of Oak Ridge Farm, Oak Ridge, Va. (Photo loaned by C. H. Yates, Mgr.)

strains. The older type of the breed was of a darker color than the Tamworth of to-day, and this suggests the possibilitiy that there may have been some crossing with the white breeds of Essex and Suffolk, or perhaps with the Italian Neapolitan type.

As early as 1847 the Tamworths were prize winners in the English show ring, but after that date their popularity seems to have markedly declined, and it was not until the early 80's that the breed again came into prominence.

The first importation of Tamworths into the United States was made by Mr. Thomas Bennet, of Rossville, Ill., in 1882. Follow-

ing this there was a considerable adoption of the breed by Canadian farmers, and since 1888 large numbers of the breed have come into Canada. Most of the recent importations into the United States have come from Canada.

General Characteristics.—The Tamworth is especially noticeable as a long, lean, sandy, or red colored hog. The head is long and narrow and has an especially long snout. The ears are large and carried erect or directed forward. There is no breaking over of the ears in pure-bred stock. The back is long and narrow and the sides correspondingly long and fairly deep. The legs are ex-

Fig. 26.—"Agnes B," No. 6971. Her winnings for 1912 and 1913 were eleven firsts and ten championships, including first in the aged class at Chicago International. Property of Oak Ridge Farm, Oak Ridge, Va. C. H. Yates, Mgr.

ceedingly long and well boned, giving the breed a great amount of activity. Hams and shoulders are strong and powerful, but not heavy fleshed.

The Tamworth is a large hog, coming next in size to the Large Yorkshire among the bacon types. Fully matured boars often reach a weight of as much as 600 pounds. The pigs at six months average about 200 pounds. In maturing this breed is often exceedingly slow, and this forms one of the principal objections to the breed. The hair is fairly fine in texture and of a sandy-red color.

Disposition of the hog is gentle, but they are wild, and often al-

most nervous in nature. As previously stated, they are not rapid in maturing, but produce an excellent type of bacon, in which the lean is very abundant and well intermixed with the fat. For this reason they are popular with the foreign trade, but American packers do not offer any premium for hogs of this type. They are most prolific breeders, producing large litters. The sows are good milkers and the pigs quite hardy.

On account of their breeding properties and their ability as rangers the Tamworth boars make a good cross for grade sows of

Fig. 27.—Tamworth sow, Oak Ridge, "Annie II," first at Virginia State Fair, 1913. First and champion sow, Chicago International in yearling class, 1913. Property of Oak Ridge Farm, Oak Ridge, Va. C. H. Yates, Mgr.

some of the more clumsy, less prolific breeds. American breeders, however, have never fancied the narrow backs and long noses of the Tamworth breed, and their distribution in this country is comparatively small. The principal states in which they are to be found are Illinois, Michigan, and Iowa. A strong effort is being made at the present time to increase the popularity of the breed in the South.

Record Associations.—Associations for the registration of the Tamworth exist in England, Canada, and the United States. The

association in this country is known as the American Tamworth Swine Record Association, and was organized in 1897.

HAMPSHIRE, OR THIN RIND

History.—This is a breed of American swine of which the history is very indefinite. As far back as about 1820 a retired sea captain, named MacKay, living near Boston, imported some hogs which afterward became known as Thin Rinds. In Kentucky for many years there has been a breed of swine which was also known as Thin Rinds. The source of these Kentucky hogs is surrounded by

Fig. 28.—Hampshire boar, "General Lipton," No. 1677. Owned by Isoni J. Martin, Lancaster, Mo. First prize Iowa State Fair, 1913.

more or less obscurity. Some claim that the Kentucky hogs were purchased from eastern breeders in the early 30's, while others assert that they came from Tonquin, China, by way of New Orleans.

For many years this breed was known as Thin Rinds, no doubt on account of the thin character of the skin. In 1904 the American Thin Rind Association voted to change the name of the breed to American Hampshire, and it is under the name Hampshires that the hogs of this type are now officially recognized. In England there also exists a breed known as the Hampshire, but they are not identical with the American Hampshire.

General Characteristics.—The American Hampshire is a medium-sized animal of the bacon type, the most prominent characteristic of which is the presence of a white-colored stripe or belt extending around the body at the level of the front feet and shoulders. The front limbs are also white in color. Some breeders cross with the purpose of eliminating this white belt and producing an animal that is entirely black.

The head is of medium size and of the straight-faced type, rather than of the dished appearance seen in the small type of Yorkshire pigs. Shoulders and hams are only of medium fulness; back average in length, moderately wide, and well supported.

Fig. 29.—Hampshire sow.

Sides are of the bacon rather than lard type. The legs are inclined to be rather long, but are well boned, firmly placed, and have good feet and pasterns.

The average weight of the Hampshire hog is about 400 to 500 pounds. A pen of this breed, which won the prize at the International Stock Show in Chicago a few years ago, averaged 493 pounds.

Good Breeders.—As a breeder the Hampshire is quite prolific, producing a litter of 10 to 12 pigs. The sows are good mothers, good milkers, and easily managed. The hog crosses fairly well with the short, blocky type of grade sows, and gives them greater

fecundity, more action, and develops a pig of the bacon rather than lard type. As grazers these hogs are an excellent breed, and on hillside and wood pastures they are excellent feeders. This no doubt in large part accounts for their popularity in the Kentucky districts, where they grew into prominence.

The Hampshire dresses out well and produces a meat which is of excellent quality, possessing a fine grain and a desirable amount of lean meat. The breed has repeatedly been among the blue-ribbon winners at the International, both in the live and dressed carcass divisions.

American desire for a lard type of hog has, however, prevented the Hampshire or any other type of bacon hog from gaining

Fig. 30.—Champion pen of Hampshire barrows at International Stock Show, 1913. Owned by C. Brook, Washington, Iowa.

wide popularity. Hampshires are to be found principally in Kentucky, with a few herds in Indiana and Illinois. The breed is protected by the American Swine Record Association, which has its headquarters at Peoria, Illinois. In recent years the breed has made more advance in Illinois than in any other state, and several of the prize-winning exhibition animals have come from this state.

SMALL YORKSHIRE

This is the breed which may well be classed as one of the smallest and showiest of the breeds to be found in America to-day. The Small Yorkshire is a short, fat little animal, which, when fully

matured, does not average much better than 200 pounds, and for showy fancy points is quite characteristic.

Early History.—The early history of the breed is quite obscure. The first definite records of the breed show that the Small Yorkshire was in existence about 1818. At that time Charles Mason and Robert Colling, of Yorkshire, England, were breeding a small white hog, which was known as Chinese White. The ancestry of the stock owned by these breeders is unknown.

Following this time the breed became rather widely disseminated throughout England, appearing to be particularly popular with breeders of short-horn cattle, a fact that is largely explained

Fig. 31.—Small Yorkshire sow.

by the fact that Mason and Colling were well-known short-horn breeders. These Chinese hogs appear to have been crossed with other small white breeds prevalent at that time in England, such as the Solways, Cumberlands, and White Liecester. As a result, there was some gain in size and vigor by the breed. The select types derived from crossing of these strains is believed to represent the foundation of the present Small Yorkshire type.

The breed, from its many showy points, has long been a favorite with the noblemen of England for show-ring purposes. In the English shows the breed is also referred to as the Small White hog. The first importations into America are a little indefinite. There is a more or less obscure record of the breed in the United States

as early as 1860. Colonel Richard M. Hoe, of New York, and William H. Cole, of New Jersey, both made importations of Small Yorkshires into the United States during the 70's. At the present

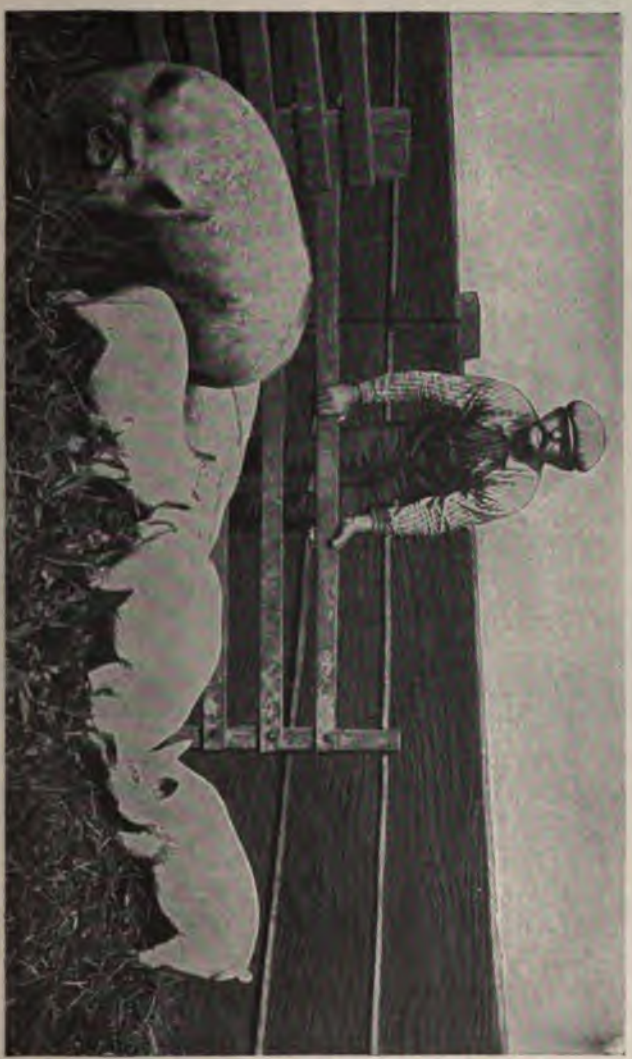

Fig. 32.—A small Yorkshire sow and litter. (From Coburn's "Swine in America," Orange Judd Company, publishers.)

time the breed is largely limited in this country to a few breeders in the eastern states and a scattered number of herds in the Middle West. There are two Yorkshire associations in this country, one

with headquarters at New York City, N. Y., the other with offices in St. Paul, Minn. The Minnesota association also records the Large Yorkshire breed.

General Characteristics.—The Small Yorkshire is a very dandified-looking animal, short and thick set, white in color, and reaching an early maturity. The head is short, and has a very marked dishing of the face, in fact, so much so that the nose points almost upward in well-marked specimens of the breed. The under jaw also shows a well-marked upward curvature. The shoulders and hams are well rounded and deeply laid with flesh. The back is short, broad, and deeply laid with fat. The legs are of medium length and fine bone.

Quick Fattener.—This breed develops very rapidly, and is a quick fat producer. In England, its native home, the hog is not a popular one with butchers, on account of the fact that it contains too large an amount of fat in proportion to the lean meat. This gives a very undesirable bacon, and it is the bacon type of hog that enjoys popularity in England as well as other parts of Europe.

Good Breeder.—The Small Yorkshire has been used with a great deal of success for cross-breeding with larger and coarser breeds, to which they have imparted fineness and increased rapidity of maturity. The animal is a fair breeder, producing average size litters and being good mothers.

For grazing the Small Yorkshire is not extra well suited, owing to their shortness of limb and compactness of form. They are more suited to the needs of the market gardener and city farmer. They do well under crowded conditions, and quickly convert waste and garbage into money.

The closest resemblance to the Small Yorkshire is to be seen in the Suffolk breed. They closely resemble each other, the Small Yorkshire being the smaller of the two and having a more dished face.

LARGE YORKSHIRE, OR LARGE WHITE

History.—The improved Large Yorkshire of the present day is a descendant of the Old Yorkshire, one of the oldest of the English breeds. This old breed has existed in England from the earliest periods, and was described as a very coarse, rough, white animal, with coarse hair and possessed of great activity, very pro-

lific as a breeder, and quite hardy. In its early history the breed was principally raised by factory hands and artisans living in and around the cities of Leeds, Keighley, and Skipton. These men crossed the coarse Yorkshire breed with the more refined white pigs of Cumberland County, and with the white Liecesters and later with the Small Yorkshires.

Joseph Tuley, an artisan from Keighley, showed an excellent animal of the improved Yorkshire type at the Royal Agricultural Show in 1851. The animal was a prize winner, and attracted considerable attention to the breed. From a boar, "Samson," and a sow, "Matchless," Mr. Tuley developed much of his famous

Fig. 33.—Champion Yorkshire sow, Minnesota State Fair, 1910.

stock. A few years later a Mr. Wainman, of Carhead, Yorkshire, began improving on the Tuley stock, and developed a herd of exceptional quality, from which he made importations over the entire world. Mr. Spencer, of St. Ives, later became a famous breeder of the Large Yorkshire hog, and has done much to bring it up to its present standard.

General Characteristics.—The Large Yorkshire is a very massive animal, often scaling over 1000 pounds. Animals of this breed are white in color and rather coarse in general appearance. The head is of medium length, with a slight upward curve. The ears of the best animals are erect or point slightly forward. They incline

to be heavy and droop quite pronouncedly. The back is narrow, with rather weak loins. The body is long, fairly deep, and of the decided bacon character rather than the lard type, which meets such favor in the United States. Hams and shoulders are fairly well rounded, but are not expected to be of the heavy type seen in

Fig. 34.—"York of the Cedars." Weight, 200 pounds. (Photo loaned by W. H. Fisher, Columbus, Ohio.)

the lard breeds. The legs are rather long, large boned, and have well-placed pasterns.

The hair is inclined to be coarse, and should be pure white in color. Dark spots in the skin are admissible, but are objected to by breeders. The white hair and unpigmented skin make this breed, as in the case of the Chester-White, susceptible to the action of the sun, and in the Central Western States mange and scurfiness are common in these breeds.

Large Yorkshires were introduced into the United States about 1840, and in 1841 A. B. Allen, of Ohio, imported a pair from England. From time to time, for over fifty years, the breed has been imported in small numbers, but no great amount of interest was developed in the animals. In 1893 Wilcox and Ligett, of Minnesota, imported some modern specimens of the breed, and this herd is the foundation of most of the Large Yorkshires now to be found in the United States. Canadian breeders have raised this type for a number of years, and most of the high-class Large Yorkshire herds on this side of the Atlantic are to be found in Ontario.

Fig. 35.—"Della of the Cedars" as a yearling champion sow of the breed at 1912 International. (Photo by W. H. Fisher, Columbus, Ohio.)

The raising of bacon hogs for the English market is very popular in Canada, and this, in large measure, accounts for the popularity of the breed in that country. One of the leading breeders in the United States is Mr. W. H. Fisher, of Columbus, Ohio.

In the United States the Large Yorkshire does not meet with favor for a number of reasons. In the first place, the hog is not of a type that is popular here. In the Central West the farmers like a hog that shows rapid development, broadness of back, and rapid weight-producing qualities. These are not to be found in the Large Yorkshire. This breed is slow in development, and does not

seem to take well to the class of foods to which our lard types are accustomed. Neither is the Large Yorkshire a good grazer on American pastures. These points of objection are very serious ones in the eyes of the American breeder, and, when to this we add the fact that there is no great demand either from the local trade or from the packers for a bacon type of hog, it is easy to see why the Large Yorkshire is not a prominent animal in the Corn Belt feed lots.

In breeding, the Large Yorkshire is a prolific animal. The litters are large, the dams are good milkers, and the pigs are hardy,

Fig. 36.—Group of Large Yorkshires at "The Cedars," Columbus, Ohio (Photo by W. H. Fisher.)

but are slow in development. They cross fairly well with other breeds of early maturing qualities, and impart action, increased size of litter, and hardiness.

The Large Yorkshire is protected in this country by the American Yorkshire Association, which has its headquarters in the state of Minnesota.

Middle Whites or Middle Yorkshires.—In England they recognize a third breed of Yorkshires, which are known as the Middle Whites or Middle Yorkshires. This breed is not officially recognized in America. The breed is derived by breeding a Large Yorkshire boar on Small Yorkshire sows, or by culling out medium-sized animals from the Large Yorkshire herds.

CHESHIRE

This is an American type of hog also, having originated in the state of New York. Jefferson County, which borders on the east coast of storm-swept Lake Ontario, is the native home of the Cheshire breed. The first record of the breed dates back to about 1855, when two citizens of Jefferson County, named Brodie and Hungerford, imported a large Yorkshire boar. This animal was crossed with some of the native stock, and a short time after the newly developed strain was crossed with animals of the White Suffolk type.

History.—Mr. A. P. Clark, of Belleville, N. Y., began showing this class of swine as a separate breed at the New York State Fair in 1859. In 1870 this same breeder brought a pen of the animals west, and entered them in competition with other hogs at St. Louis for a $500 prize offered by the packers of that period. The Clark exhibit carried away the blue ribbon, but, for some reason, this victory of the breed does not appear to have been followed by any such gain in popularity for the Cheshire, as one would naturally expect as the result of receiving championship honors in a competition of this magnitude.

Origin of Name.—The origin of the name "Cheshire" is more or less obscured in uncertainty. There is no record of any blood of the old English breed of this name being introduced into the herds of the Jefferson County breeders, and no one seems able to explain exactly the origin of the distinctive name under which the hogs of this breed are now officially recognized. The name was officially awared, however, at the Swine Breeders' Convention in Indianapolis in 1872.

In the financial crisis of 1873 the hog-breeding industry, with many others, suffered severely, and the breed of Cheshires almost dropped out of existence. Mr. E. W. Davis saved them from total disappearance, and to his efforts is largely due the credit for the preservation of the breed. In 1884 the Cheshire Swine Breeders' Association was formed, and is at present the most potent agency in the promotion of the interests of breeders of this strain.

General Characteristics.—The Cheshire is a very neat, stylish-appearing hog, white in color, fine of limb, and graceful in movement. The breed somewhat closely resembles the medium-sized

Yorkshire in size and appearance. The head is short in proportion to the length of the body, and the face is considerably dished and wide between the eyes. The ears of this breed are small, fine, and pointed. In the young animal they stand almost erect. In older hogs they point somewhat forward.

The neck is inclined to be rather short and full, the shoulders well formed and rounded. The body of the Cheshire is long, but is likely to show a lack of depth. The back is fairly broad and almost straight, the arching being very slight or entirely absent. Loins are also broad, well fleshed, and straight. The tail is rather small, slender, and pointed. The hams are broad and quite well filled out, extending well down on to the hock.

In the pure-bred Cheshire hog the legs are inclined to be a trifle beyond the medium in length, and are quite fine of bone. In fact, the bony framework may tend to become overdelicate and produce apparent weakness. Pasterns are fairly firm and the foot is well placed on the ground. The legs are rather wide apart and give excellent motion and grazing power. The hair of the Cheshire hog is of fine texture and white in color. Black hair is regarded as a disqualification, although dark blue spots on the skin are not regarded as disqualifying.

In *disposition* the Cheshires are very peaceful and easily handled. This makes them fairly good breeders, and the breed is also fairly good as a feeder. Experiments made several years ago at the Maine State Experiment Station showed that the Cheshire does not make a corresponding gain with other breeds on the same amount of feed. This breed crosses fairly well with other types of American swine. Especially does the mixing of this type do well when crossed with those of larger frame and heavier bone.

The Cheshire produces a meat which is of excellent firmness and fine grain. When cooked it has a juicy, sweet, tender quality, which is very palatable. This fineness of grain of the meat tends to give the animals much heavier weight than would be judged from their size. Plumb, in his work on "Breeds and Breeding," quotes an instance of where a breeder attempted to sell some animals of this breed at lump weight for 325 pounds. The buyer refused, as he averaged the hogs to weigh about 300 pounds. When actually scaled they proved to weigh an average of 390. It is not unusual

to have carcasses of this breed dress out between 300 and 400 pounds.

Distribution of this breed is only fairly widespread. Perhaps not more than twenty states in the United States have Cheshire herds, and of these nearly all are in the eastern part of the country. New York State alone has more Cheshire hogs than all the other states put together. Under the feeding conditions present in that state the hog appears to do exceptionally well, and produces a bacon which is quite acceptable for export trade as well as dressing out a good lard carcass.

There are a few Cheshire herds in Canada, but here, as in the western part of the United States, the breed does not seem to meet with popularity. This may in part be due to the fact that the animal is of a somewhat different appearance than the heavier breeds which are popular with Corn Belt feeders, and also it is probably partly explained by the fact that the Cheshire is not as good a fat producer as the more massive Polands, Durocs, and Berkshires that hold sway in the western feed lots.

THE IMPROVED ESSEX

Origin.—This breed is the result of the crossing of an Italian breed, known as the Neapolitan, with the old style Essex hogs of England. The original home of the Essex stock is Essex County, England. This county is but shortly removed from London, and is one of the leading hog-producing counties of the island. The old records of the Essex breed shows that in the early history of the swine industry in this county there was developed a native breed which was black and white in color and of a coarse build. These animals were large, rangy, long legged, very wild, long snouted, roach backed, and flat sided. They are also recorded as being possessed of an enormous appetite, but showed comparatively little gain in weight for the volume of food consumed.

History.—Lord Western, one of the leading swine breeders of the county, in 1830 made a visit to Italy, and brought back with him a male and female of the Neapolitan breed common in that country. These Italian hogs were crossed with some of the best appearing of the native stock. The cross made a marked improvement in the type. The size of the animal was reduced, the bone

became finer, the legs were shortened, the new breed consumed less food, and showed a better fat return; the color was changed to an all black. This new breed was for years classed as the Essex-Neapolitan. There was also probably some Suffolk and Berkshire blood intermingled in these early crosses. Lord Western made the mistake, however, of too close inbreeding, and, as a result, the breed was weakened in constitution, reduced too greatly in size, and decreased in breeding properties.

On one of Lord Western's English estates he had a tenant by the name of Fisher Hobbs. It is largely due to the breeding of this gentleman that the Essex type of to-day was established.

Fig. 37.—An attractive Essex gilt. (From Coburn's "Swine in America," Orange Judd Company, publishers.)

About 1840, or a little before, he secured an Essex-Neapolitan boar from Lord Western, and crossed this breed with some of the rough and hardy native Essex stock. This restored in part the hardiness and desirable qualities of the breed. On the death of his squire, in 1844, Mr. Hobbs purchased the pick of his herd, and added them to his own. This formed the basis for the development of the new breed. This breeder won many prizes at shows in England in the early 40's, and this gave marked prominence to the breed. In the adjoining county of Suffolk the Improved Essex type, as represented by the herd of Mr. Hobbs, became very popular, and this county is to-day the most pronounced breeding locality of the Essex. On account of its predominance in Suffolk rather than in Essex

the breed is often referred to as the *Black Suffolk* or the Small Black breed.

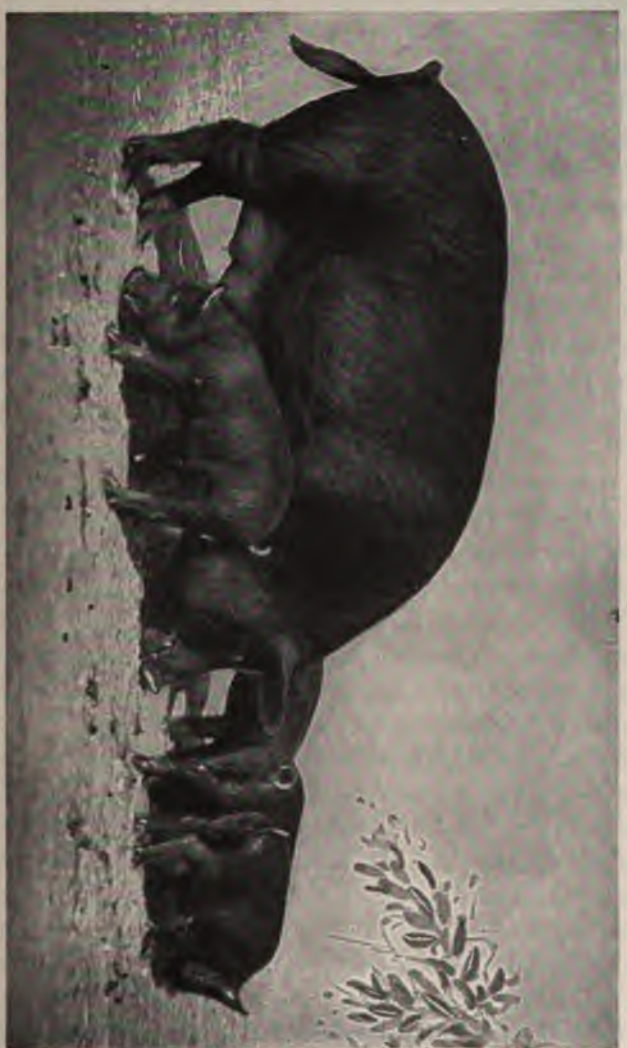

Fig. 38.—An Essex sow with her litter. (From Coburn's "Swine in America," Orange Judd Company, publishers.)

About the middle of the past century the Essex swine were imported into New England and other eastern states. The breed has never gained any widespread distribution or popularity in the United States, and only comparatively few states show

Improved Essex herds. In Canada there are a number of herds to be found in the Province of Ontario. Other English-speaking countries have also received importations of the breed, but their small size and lack of breeding qualities are a great handicap for public favor when in competition with such breeds as Berkshires, Polands, Durocs, and Chester-Whites. In the southern part of the United States the breed has met with considerable favor, and the number of Essex swine south of the Ohio River is on the increase. The breed is more suited to local conditions in that section than some of the heavier breeds.

The states in which the Essex breed has the widest distribution are Michigan, Nebraska, Texas, Illinois, Indiana, Ohio, Georgia, Tennessee, and Kentucky. The interests of the breed are looked after by the American Essex Association, of which F. M. Strout, McLean, Illinois, is secretary. This organization was formed in 1887.

General Characteristics.—The Essex is a small black animal, averaging in weight not much above 300 pounds under ordinary conditions. Some of the more enthusiastic breeders of the Essex claim to produce a mature hog that will weigh in the neighborhood of 500 pounds, but the average weight is much less. The breed is very early in maturing, and is especially well suited to the man that raises but one or two hogs a year, such as the market gardener or the city pig stye.

This breed has a short head, face well dished, and broad between the eyes. The ears are small, fine, smooth, and erect. They may droop slightly in the aged animal. Jowls are full, neat, solid, and carry their fulness well back. Neck is full, short, and slightly arched. The back is nearly straight, broad, and should carry the same width from shoulders to hams. The ribs are flat and well sprung in accordance with shoulders and hams. Sides are fairly deep and the flanks come down well on a line with balance of the body. The hams should be broad and full and the loins wide and well fleshed. The legs tend to shortness and the animal accordingly stands fairly close to the ground. The bone is fine and the limbs neat and graceful. Feet are well placed and pasterns firm.

In disposition the Essex is very mild and easily handled.

This gives them excellent feeding qualities, and there is no breed that can be pushed more rapidly and fattened to a greater extent for their size than the Essex. This overfattening has weakened the breeding capacity of the breed and they are relatively poor producers. The sows are also rather poor milkers and the litter is often partly lost.

The fully developed Essex is a short, chunky, black hog, neatly proportioned, graceful in movement, and a very nice appearing animal, but lack of size and poor breeding qualities deprive the breed of popularity with large American breeders. The meat produced by swine of this breed is fine grained, firm, and very desirable.

Crosses.—As a cross with other larger and rougher breeds the Essex has been largely used, and many of the standard breeds of to-day owe no small part of their improvement to the cross with Essex strains. The Essex blood gives a more rapid maturity and increased feeding qualities.

THE IMPROVED SUFFOLK

History.—Nearly a century ago the Suffolk was a prominent white breed in Suffolk County, England. In the stock shows of that time, and for the first fifty years or more of the past century, the breed was a prominent one in the prize ring of that country. After the development of the improved Essex and Essex-Neapolitan breed the breeders of Suffolk began to cultivate that type, and the native Suffolk was allowed to pass into obscurity, until to-day the hog which is known in Europe under the name of Suffolk is a small black animal instead of white.

The breed has, to some small extent, been preserved in this country, although its distribution here is only small, and the breed does not appear to be gaining in popularity. About 1855 Hon. John Wentworth, of Illinois, imported from England some swine of the then prevailing type in Suffolk County, England. These hogs were the basis for the Improved American Suffolks. This type somewhat closely resembles the Small Yorkshire breed, and there is some question as to whether or not the original importation was not of this blood instead of Suffolk.

There are perhaps about two thousand registered animals of this breed in the United States. The principal distribution is in

Illinois, Michigan, Iowa, and Indiana. There are also a number of herds in Canada.

General Characteristics.—The Suffolk is very much of the same general appearance as the small Yorkshire, but somewhat larger. The Suffolk has a relatively small, short head, with a well-dished face; small, very short snout; firm, well-filled jowl; short, erect ears and a very short thick neck, which gives the animal an appearance very much as if the head was set directly upon the shoulders. The shoulders are heavy and prominent, the chest wide and deep, and the back broad and inclined to be of good length. The hams are well rounded, wide, and full. The legs are very short, and in the sow are just about long enough to keep the belly off the ground. They set wide apart and are fine boned. The tail is thin, long, and tends to taper quite markedly.

The *skin* is thin and of a pinkish color. The hair is thick, fine, and silky in appearance and of a yellowish-white color.

Easy Keepers.—This breed is an easy keeper, and is especially desirable as a hog to be kept where quarters are rather crowded, as in city feed lots. The hog is always in good condition, matures rapidly, and shows the most profitable returns when marketed at about the age of six months, under rather than over. They are poor grazers, owing to the shortness of limb and the heaviness of body. As breeders also they are not prolific, and the mothers do not make overly good nurses. This breed has been used to some extent for crossing with other heavier and coarser breeds where it is desired to improve the type and produce more rapidly maturing qualities.

The nearest breed in comparison to the Suffolk is the Small Yorkshire, which they so closely resemble as almost to be regarded in many quarters as one and the same.

THE VICTORIA

The origin of what is now generally regarded as the Victoria breed of swine is accredited to Mr. George Davis, of Lake County, Indiana. The history traces back in the Indiana breed to a sow known under the name of "Queen Victoria," from which the breed takes its name of Victorias. Mr. Davis established this definite type of swine by crossing of Poland-China, Berkshire, Chester-

White, and Suffolk blood. The origin of the breed is quite recent, Mr. Davis having first started the breed as a definite type about 1870.

Fig. 39.—A pen of fat Victorias. (From Coburn's "Swine in America," Orange Judd Company, publishers.)

There is another type of Victorias known under the name of the Curtis Victoria Breed which originated with Colonel F. D. Curtis, of Saratoga County, N. Y. This breed was founded about 1850, and was developed from Irish Grazier and Byfield stock.

With these there was crossed Yorkshire and Suffolk blood. The Indiana pig is the only one which is covered by registration and organized association protection. The Curtis breed is probably no longer in existence as pure-bred stock.

General Characteristics.—The Victoria pig is a medium large-sized, white animal, ranking in size between the Duroc and Poland-China. The head is small, broad, and has a well-dished face. The ears are small, fine, and carried erect. The jowls are neat and firm; the neck short, full, and well arched. The shoulders and hams are broad, deep, and well rounded. The back is broad and well fleshed; the ribs long, broad, and well sprung. The sides are

Fig. 40.—Victoria sow (U. S. Dept. of Agriculture).

deep and full. The tail is medium length, attached on a line with the back, and is usually carried in a curl. The hair is fine, silky, and free from bristles.

In general appearance the Victoria is a strong, graceful-appearing animal. The legs are of medium length and the bone of moderate fineness. The animal is a good grazer, and is reported to be an excellent feeder by its advocates. At the large stock shows the Victorias have been consistent prize winners both in the live stock and the dressed carcass exhibits, but for some reason have not gained rapidly in popularity.

Good Breeders.—Crosses with other breeds have not been carried on to a sufficient extent to determine the desirability of the

breed from this standpoint. Supporters of the Victorias claim for them excellent breeding qualities with large litters that are well nursed. The distribution of the herds is largely in Indiana, Illinois, Ohio, Wisconsin, and Michigan.

Free from Mange.—An especial point in their favor which has been claimed for the Victoria hogs is that they are the least susceptible of the large white breeds to the various skin diseases which have been a hindering factor in increasing the popularity of the Chester-White and other white-haired breeds.

INFECTIOUS DISEASES OF SWINE

Germ Diseases.—In the past thirty years a great amount of knowledge has been obtained relative to the cause of many diseases which previous to that time had been believed to be due to conditions producing changes in the ground or in the air. Such diseases were often referred to as being due to a miasma. The renowned Dr. Koch, of Berlin, Germany, was one of the founders of the germ theory of disease, and we now know that a great number of diseases which we formerly were unable to understand are produced by some form of germ. In a great many instances the specific germ which causes the condition has been isolated and proved to be the cause of the mischief. For instance, in tuberculosis we now know that the disease is due to a special form of germ which is known as the bacillus of tuberculosis. The germs that cause sickness in man or in animal are of such small size that they can be seen only with the most powerful microscopes.

When examined under the microscope some germs are seen to be long and narrow in appearance. These are called bacilli. According to this plan, the germ which causes typhoid fever in man, being a long rod-shaped germ, is called the typhoid fever bacillus. In like manner, the large rod-shaped germ that produces anthrax in farm animals is known as the anthrax bacillus. Another type of germs are seen under the magnifying lenses as round, dot-like bodies. These are known as cocci. For instance, if the pus from a simple abscess be examined it will be found to contain a large number of these round germs, which are known as staphylococci. Sometimes these round germs are seen arranged in long thread-like chains. They are then called streptococci. Still another form of germs are seen which have a corkscrew-like, spiral appearance. These are classed as spirilla.

Definition.—Any disease which is caused by a germ is known as a germ disease or, more commonly among the profession, as infectious disease. By an infectious disease we mean, then, a disease

which is produced by some form of germ. These germs are not always capable of demonstration. For instance, hog-cholera is classed by practically all writers as an infectious disease, but no one can demonstrate the germ which is the cause of the condition. Hog-cholera shows so much resemblance to other infectious diseases, however, that it is practically a positive conclusion that some germ is present which is causing the disease, but which has so far eluded the efforts of the most scientific workers to show its presence, even under the microscope.

It is characteristic of these infectious diseases that they can be transmitted from the sick to healthy herds. Some infections are very rapidly carried from one animal to another. In fact, with many of them, mere contact in the same pen with the sick seems sufficient to transfer the infection. Such diseases as this are classed as "catching" or contagious. In other infectious diseases it is necessary for the germ to be carried in some manner from the body of the sick to the well animal in order to transmit the disease.

With this explanation, we are now ready to take up some of the important diseases of this class, of which hog-cholera is, by all means, the most common and most interesting to both veterinarian and stockman.

HOG-CHOLERA

Hog-cholera is a severe, acute disease of swine, which is caused by an invisible germ, and which is recognized by the production of severe symptoms, principal of which are loss of appetite, cough, diarrhea, red blotches on the skin, and a very peculiar turkey-egg spotting of the kidneys, seen when the body is cut open after death.

HISTORY

Hog-cholera was no doubt first brought into this country by the importation of hogs from Europe in the latter part of the 18th or early part of the 19th century. The early history of the disease in the United States is not definitely recorded in the literature of that time, but this disease, like many others, seems most likely to have been brought into the country from England. Many of our

most fatal animal diseases have been introduced into the country in this way by the importation of animals from Europe.

However the disease got into the country, it at least got a firm foothold before its nature had been recognized and proper measures taken to stamp it out. Ohio was the scene of a quite severe outbreak of this disease in 1838, and large numbers of herds were wiped out by the disease at that time. In the following year it was spread from Ohio to the neighboring states, and also to the states south of the Ohio River. Unfortunately, we had no well-organized Department of Agriculture or Bureau of Animal Industry at that time, and, accordingly, the disease gained a foothold which was destined to remain permanent.

In connection with this matter of history, it might be well to point out the efficient methods of dealing with such diseases that we now possess through the activity of our national government and the Bureau of Animal Industry. Foot-and-mouth disease, a dread disease of cattle which is very widespread in parts of Europe, has repeatedly threatened to get a foothold in this country, especially in the eastern part of the United States, but each time the disease has made its appearance prompt work upon the part of the officials of the Bureau of Animal Industry has suppressed the outbreak in its incipiency, and the dairy herds of our country have been saved from its ravages. What a wonderful saving in millions it would have meant for the hog producers of this country if we had had some such efficient agency in the early 40's to have taken aggressive action against the hog-cholera invasion of that time and have eradicated it from the Ohio Valley.

Unfortunately, however, no such action was taken, and the seeds of infection soon became widely sown. Epidemics broke out in various parts of the country. Herds were devastated and thousands of dead animals left in its wake as it spread like a forest fire from the peaceful pastures of the Ohio Valley all over the hog-producing belt. No thorough systematic effort has ever been made looking to the eradication of the disease, and, as a result, it is now constantly present in every state where hogs are raised, and is the dread of the hog raiser in every part of our country. With the further development of the serum treatment measures are to be hoped for, looking not only to the treatment of sick and exposed

animals, but also to the final eradication of hog-cholera from American soil, as has been done in the case of foot-and-mouth disease and contagious pleuropneumonia.

THE CAUSE OF CHOLERA

As is the case with many diseases present in man, hog-cholera has long been believed to be due to some sort of germ infection. The discovery of germs and their relation to disease was made only within the past fifty years, and ever since this germ relationship to disease has been proved, veterinary surgeons in this country and in Europe have been trying to discover some germ which could be definitely set down to be the cause of hog-cholera.

Hog-cholera Bacillus.—About 1885 the officials of the United States Bureau of Animal Industry discovered and described a germ which was called the bacillus of hog-cholera, and which was for many years believed to be the active cause of hog-cholera.

This germ was very small—only about five-one-hundred-thousandths of an inch in length—shaped like a rod, and with rounded ends. The hog-cholera bacillus is very active, and when looked at on a glass slide under the microscope is found to possess a number of hair-like legs called flagella, by means of which it has the power of very rapid movement. In the laboratories of our state colleges and in every laboratory where studies of germs are made this germ can be easily grown on the various forms of culture-media or germ foods which are there used for that purpose. It grows best in foods that contain a small amount of salt, and shows its most rapid growth when these foods are kept at about the temperature of the animal body. In these laboratories special germ-growing incubators are provided for this purpose. It will grow either in the presence or absence of air. The germs multiply by simple division or fission. In these laboratories many stains are used by which the germs can be stained when mounted on glass slides and very beautifully demonstrated under the microscope, which is a powerful magnifying instrument used for the purpose of examining germs.

Not True Cause of Cholera.—In the blood and in the ulcerated bowels of an animal that has died of hog-cholera the hog-cholera bacilli are found in very large numbers, but in the past few years we have come to doubt that this germ is the cause of cholera, be-

cause it has been found that hogs do not always develop this disease when exposed to or fed with this organism, and it is found that the disease often produced by these germs is not catching to other animals as is the genuine cholera. So that at this time it can be positively stated that the hog-cholera bacillus is not the direct cause of hog-cholera, but is a germ which makes its appearance after the disease is established.

Ultramicroscopic Virus is True Cause of Cholera.—Repeated experiments with the blood of animals sick with cholera have proved that there is some poison or virus in the blood of the cholera hog which is so small that it even cannot be seen with the highest power of the best microscopes, and this virus is also so fine in character that it will pass through the finest porcelain filters. This is what is called an *ultramicroscopic virus*, and it is this ultramicroscopic virus which is now generally agreed to be the cause of hog-cholera.

So that we are now forced to say that the direct cause of the disease (hog-cholera) is some invisible virus, which is so small that we are unable to observe it even with the best of microscopes, and which is capable of passing through the finest filters. Such an organism is what is called ultramicroscopic. By the word "ultramicroscopic" we mean something that is so small that we are unable to see it with the most powerful magnifying glasses with which our modern microscopes are provided. This, then, is the sort of germ which produces cholera. It is so minute that we are unable to see it even with the microscope, yet we are certain that it is there, because we can take the blood or infected discharges of the animal and produce the disease in healthy animals.

How Germ Enters Body.—The virus of cholera enters the body of the healthy animal probably, in the majority of cases, through the mouth, and thence through the stomach and bowels. It is obtained most frequently by eating some diseased articles of food, such as carcasses of hogs which have died of cholera or discharges from sick animals.

Spread.—There are hundreds of ways by which these disease-producing discharges may be carried to the healthy hogs, as will be pointed out under the head of Predisposing Causes and Preventive Treatment. The most common ways are by direct contact with

sick animals in the same pens; through infected water; by eating of bacon trimmings and other waste meat products from hotels and restaurants; by eating portions of dead carcasses which have been carried into the feed lots by dogs or other means; by eating food which has become infected by coming in contact with the boots or shoes of those who have come from infected feed lots, such as butchers, drovers, and hog buyers; or by mixing the germs with other dead carcasses from the talons of buzzards and crows which have come from a feast upon the dead body of hogs which have just died from cholera.

In a few cases the disease-producing material is probably carried into the body of the well animal through the lungs; that is, it is breathed in with the air. In seasons when hog-cholera is prevalent the dust blown from cholera feed lots by whirlwinds and sudden gusts of wind carries with it a considerable amount of infectious material, and, without question, some few cases of cholera are produced by the breathing in of this disease-laden dust. Such cases usually show the most marked symptoms in the lungs and throat, especially in the lungs. This is the class of cases which show the most frequent complications of pneumonia and which were formerly regarded as a separate disease—swine plague. However, we may, and do, have cases with very severe changes in the lungs which are not due to breathing in of infected dust. The disease is not carried any great distance through the air, and hogs can be kept as close as 10 feet to an infected herd with very little danger of becoming infected if there is no direct communication between the two feed lots, such as men going from one lot to the other and carrying upon their shoes or boots the infected manure from the lot containing the diseased animals. Birds, dogs, chickens, pigeons, and other animals and birds are equally likely to carry the infectious material, and if the hogs in the non-infected pen are to be kept free from disease there must be no communication whatever between the two pens.

In cases where the width of a public road separates two hog lots there is but little danger of transmission of the virus of cholera from one herd to another, except through some of the means just mentioned. Unfortunately, however, there is in practically all such cases direct communication between the two feed lots.

Chickens, especially, very commonly range from one feed lot to the other in search of food, and carry on their feet the infected discharges of the sick herd to scatter them in the pens of the healthy herd. It is not long until one or more of the healthy animals takes in through the mouth enough of the disease-producing virus to set up the disease in his own body, and he then rapidly spreads the disease to the other animals of the herd.

Pigeons are another very common source of carrying this invisible virus from one hog lot to another. Nearly every farm in the Central West has a flock of a dozen or more pigeons roosting about the barns, and these birds travel from one feed lot to another in search of grain. As in the case of the chickens, they unconsciously often become the carriers of infected manure from one feed lot to another, and thus prove the source of the disease in other herds. As these birds frequently travel considerable distances in search of food, they may be the means of scattering the infection in a herd a mile or more away.

Infected Bowel Discharges.—When the disease becomes developed in the body of the animal, lesions are especially produced in the intestines, both small and large, as will be fully described in the succeeding pages. These ulcers are continuously discharging into the bowel large amounts of the hog-cholera virus, and this is carried out with the bowel movements to be scattered over the ground with the manure. Unfortunately, hogs are often so confined that in the eating of their food it is necessary for them to also eat a considerable amount of their own fecal matter. In this way the infective virus is rapidly spread from one animal to the other, entering by the mouth and setting up an infection of the bowels in the second animal.

Impure Water.—Where hog wallows are present in the feed lot considerable amounts of this fecal matter are passed in, or find their way into, the water and mud of the wallow, and thus this water becomes infected. Hogs or pigs which may drink this germ-laden water thereby carry the infected discharges to their own bodies and are rapidly attacked by the disease.

In Urine.—Hog-cholera is by no means a disease which is limited in its distribution to the intestines, as we will find when we take up the postmortem examination of animals dead of this dis-

ease. Among other organs especially affected are the kidneys and bladder. The virus is apparently absorbed from the intestines and carried by the blood to the kidneys, where it attempts to escape from the body. As a result we find that the urine of animals affected with cholera is also heavily laden with the ultramicroscopic virus which produces the disease, and water, food, or earth which comes in contact with this infectious urine becomes a source of danger, in that it is capable of producing the disease in other animals which may eat food or drink water so contaminated. Here again the factor of overcrowding becomes important, as in hogs confined in small feed lots the food and litter are bound to become more or less contaminated with urine and feces, and thus become capable of transmitting the disease to other healthy animals in the same herd.

The virus of cholera is also present in large amounts in the *blood of sick animals*, a fact made use of in the manufacture of hog-cholera serum. This must not be forgotten, as anything which comes in contact with the blood of an animal sick with cholera becomes most highly dangerous and will readily transmit the disease to healthy animals. The importance of this fact can be best appreciated when we observe the results that follow the feeding of dead hog-cholera carcasses to other healthy hogs. A small amount of the blood of a cholera animal if taken into the body of a healthy hog will produce the disease. This explains the ease with which the disease is carried for long distances by *buzzards* and *crows*. The buzzard, in tearing the flesh of the dead cholera carcass, bathes his talons freely in the blood of his prey, and then, when he flies miles away to feast upon the body of some other dead animal, such as a dead horse, which has been hauled out into a feed lot for the hogs to devour, he carries on his talons a sufficient amount of this highly infectious blood to infect the entire herd of hogs on the farm to which he goes.

In actual practice it has been found that as small an amount as 5 drops of this infected blood is capable of producing cholera when injected into healthy shoats, and in animals which are a little bit weakened by improper feeding it would only require 1 or 2 drops of the blood from a dead animal to produce the disease in them.

Caution Necessary in Use of Virus Blood.—This is a point which must be especially remembered in the administration of the serum-simultaneous, or serum and virus treatment for cholera. The virus blood which is injected with the serum is taken from the vessels of an animal which is suffering from acute cholera, and a few drops of it is sufficient to produce the disease in other animals in a few days, unless they be properly protected by a dose of serum. Great care must be exercised in the handling of this virulent blood, and any of it which is left over at the end of the vaccination should be immediately burned, to prevent any possible danger of it being scattered about in some place where it might be carried in any manner to other hogs which had not been protected by the use of serum.

All Body Discharges are Dangerous.—When a case of cholera is fully developed every one of the body discharges teem with the virus of the disease. The saliva of diseased animals carries large quantities of the virulent material, and food contaminated with the saliva of a sick hog is capable of transmitting the disease to healthy hogs. In like manner, watering-troughs may become contaminated by sick animals drinking from them.

The discharges from the eyes, which are described under the head of Symptoms of Hog-cholera, are also infectious and capable of transmitting the disease. Milk from sows suffering with cholera is also laden with the ultramicroscopic organism, and is capable of transmitting the disease to the pigs. However, pigs are so susceptible to hog-cholera that they are usually infected before the mothers from other sources, and, accordingly, are rarely made sick through the milk.

Summary.—In summing up the direct causes of hog-cholera we have the following points to remember:

(1) The disease is not due to the hog-cholera bacillus which was at one time described as the cause of the epidemics which devastated the herds in our hog belt every year.

This organism is, however, usually present in the sick animals, being especially found in the ulcers in the large and small intestines and in the feces.

(2) The actual cause of hog-cholera is a very minute organism, which is so small that it passes through the finest of filters, and

cannot be observed with the most powerful of microscopes, hence is called an ultramicroscopic virus.

We know that this virus is present, because blood taken from an animal affected with cholera and passed through the very finest filters, and proved to be absolutely free from hog-cholera bacillus or other bacteria, will produce the disease in typical form in healthy animals into which it has been injected.

(3) In sick animals the lesions in the bowels give off large amounts of this ultramicroscopic virus which pass out in the intestinal contents or feces.

(4) Large amounts of the virus are absorbed by the blood from the intestines and carried through the blood-stream to the kidneys, and thence pass out with the urine, which is, accordingly, infectious and capable of producing the disease in other healthy animals.

(5) The blood itself is especially dangerous, and is literally swarming with infectious material; so much so that as small an amount as a few drops of virulent blood is capable of producing the most fatal and acute types of the disease within a week in healthy animals.

(6) Other discharges from the animal body are also carriers of the infection—*e. g.*, the saliva, milk, and sweat. The sticky exudate formed around the eyelids during the course of the disease is also a carrier of the germs of infection.

(7) The usual manner in which the hog-cholera virus enters the body of its victims is through the mouth. It thus enters with the food and drink, more frequently perhaps with the food. It is quickly absorbed from the intestines and enters the blood, in this way producing both a local and a general infection. The germs which remain in the intestines produce the local lesions or ulcers.

(8) The virus is also sometimes taken in through the nose, and thus is first brought in contact with the respiratory tract. These are the cases which show the severe lesions in the lungs and pleura. Many of the cases showing severe lung lesions are the result of infection of these organs through the blood-stream.

(9) The virus is taken in much more frequently through the mouth than through the nose.

(10) The infection is carried from one farm to another most

frequently through the agency of some human being, animal, or bird which goes from one farm to another.

(11) Infectious material may be transmitted from one farm to another through the agency of winds carrying infected dust. This, however, is rather uncommon.

(12) The virus itself is also present in the exhaled air from a sick animal, but is carried in the air but a very short distance, probably not over 10 feet.

(13) Animals which are kept closely housed together in insanitary quarters may transmit the infection directly from one to another through the breathed air.

VITALITY OF HOG-CHOLERA VIRUS

This is a question which is open to a great deal of discussion and which is also of vast importance. Depending in large part upon this question depends the length of time which must elapse before a feed lot in which hogs have died of cholera becomes safe for other hogs.

We are handicapped in a large measure in determining these facts on account of the ultramicroscopic character of the virus with which we have to deal. Being unable to see the germ, even with the aid of microscopes, we are in a poor position to say much definitely upon the subject of the length of time during which the germ persists after its introduction.

Numerous experiments along this line have been carried out, however, in which clinical evidence alone has been used in arriving at conclusions, and the following facts have been determined:

(1) The virus of cholera will remain for several months in feed lots which have once been infected from the discharges of sick animals. Remember that all the discharges of a sick animal are infective—the feces, the urine, the saliva, the blood.

(2) The length of time during which this infection will persist is made much longer if the hog lots are shut off from the direct sunlight. The direct rays of the sun are among the best germ-destroying agencies that we possess.

(3) Corn cobs, manure and dirt, and refuse of all kinds harbor the infectious material and make it more persistent. If you desire to free a hog lot from the disease germs it is necessary after all

animals have died or been removed to thoroughly gather up all corn cobs, litter, manure, etc., and pile in one heap and burn. In this manner only can the lots be freed from the virus of cholera.

(4) Hog wallows are an especially fertile breeding-place for the hog-cholera virus, and the germs persist for several months in the mud at the bottom of these filthy, disease-breeding nuisances. Frequently the germ even seems to be able to retain its virulence in a hog wallow through an entire winter season.

In cleaning up a hog feed lot where it is desired to free the premises of cholera virus it is necessary that these wallows be drained out, and the mud at the bottom exposed to the direct action of the sun's rays for several days. Better still, replace these insanitary disease breeders by sanitary, modern, concrete hog wallows, which can be kept clean and free from disease. A concrete wallow can be drained at frequent intervals, and its inner surface thoroughly cleaned and disinfected.

(5) The virus of hog-cholera may be destroyed by a number of disinfectant substances, such as chlorid of lime or the compound cresol solution. This latter substance is a very convenient and efficient disinfectant and is prepared as follows:

Home-made Disinfectant.—Take 5 pounds of any good laundry soap, such as American Family or Swift's Pride, and dissolve in a sufficient amount of warm water. Add 1 gallon of crude carbolic acid and stir well. Then add sufficient water to make 50 gallons of solution. This should be thoroughly sprayed over the surface of the pens with a good force-spray pump. Used in connection with the chlorid of lime, this offers the very best method of pen disinfection. It cannot be expected to be effective, however, unless all waste substances, such as corn cobs and litter, are first thoroughly raked up and burned.

(6) Weather conditions have a good deal to do with the length of time that infection will persist in cholera-infected pens. Hot, dry weather, with good strong sunlight every day, will do more to destroy the virus of cholera than any other natural agency.

(7) Cold weather checks the growth and multiplication of the hog-cholera virus, but it does not entirely destroy it, and with the return of warm weather the germs rapidly regain their virulence, and attack healthy animals which may come in contact with

them, and again produce the disease. In such cases the first animals attacked may show the chronic form of cholera, but, with the passage through the body of living animals, the virus regains its original virulence, and soon begins to produce again the acute type of the disease.

(8) Runty animals which are left after an epidemic of cholera often carry in their intestines chronic cholera ulcers, and remain for months discharging virulent cholera virus, which keeps the pens constantly re-infected. These animals are a constant menace, and should be gotten rid of at once, either by slaughter or sale to butchers. In the latter case the animals usually show such lesions of cholera as to be condemned at time of slaughter.

(9) Animals which have apparently entirely recovered from cholera often prove capable of distributing the infection. Such animals should properly be classed as "cholera carriers," and often cause an outbreak of the disease in healthy herds to which they may be added. Be careful at all times in buying hogs at a public sale, or from a distance, that you do not unknowingly bring the disease upon your place.

(10) The virus of cholera is especially persistent when kept in contact with animal flesh in moist, damp places. This is one of the strongest arguments against burying of cholera carcasses. The virus will remain alive in such carcasses and in the soil in which they are buried for a year or more. When brought to the surface by burrowing squirrels, moles, skunks, or other small animals it readily regains its virulence and attacks swine which may come in contact with it.

(11) The virus of hog-cholera is effectively destroyed by proper heat, such as burning. It is for this reason that burning of dead hog carcasses, especially those that have died from cholera, is so strongly advocated. By all means it is the only efficient way of destroying the carcass, and at the same time destroying all danger of the infective virus.

(12) As a general statement, it may be said that hog-cholera-infected pens remain dangerous for a period of at least one year after the occurrence of the last case of the disease therein. This period of danger may in part be shortened by thoroughly cleaning the pens, gathering up all corn cobs, old boards, litter, manure,

and other refuse and thoroughly destroying same by saturating with kerosene and burning.

Liquor Cresolis.—Following this the pens should be thoroughly sprayed with the liquor cresolis compound above described and then sprinkled with chlorid of lime. Sheds should be cleaned with especial thoroughness, whitewashed, and sprayed with the cresol compound.

Old insanitary sheds should be torn down or burned, and replaced by modern sanitary buildings which admit plenty of light and sunshine.

Old hog wallows should be drained, the mud at the bottom either removed or thoroughly saturated with disinfectant solution, and allowed to remain exposed to the direct rays of the sun for several weeks.

New hogs added to the pens should be treated by the serum-simultaneous vaccination method, and thus rendered immune to any infection that may remain. Of this latter method of overcoming the attack of the cholera virus more will be said in the following pages.

Examples of how cholera virus will persist in pens which have once become infected are familiar to all of us, but a few illustrations may be of interest.

As a boy, in western Illinois, I can remember the case of one farmer who resided on an adjoining farm. This man had a large herd of animals one summer which became infected with hog-cholera, and large numbers of them died before the balance had been shipped to market. The pens on this farm were in a particularly insanitary condition. The hogs had the run of the cattle feed lots, and there was an inch or more of old corn cobs on the ground over the entire feed lot. These were thoroughly worked up with the mud in the feed lot every time it rained. As a result the virus was thoroughly worked into the soil during the time the outbreak lasted on the farm.

About three months after the last of these hogs had died the farmer brought in a new drove of nearly 100 hogs, which had been purchased from a herd some miles distant in a vicinity where cholera had not been present for several years.

Within ten days after the new hogs had been brought in a few of

them were noticed to be off feed, and the entire herd was at once loaded on the cars and shipped to one of the large packing centers. Even then 3 were dead before they reached the market and several others were condemned postmortem in the packing house.

The following spring this same farmer purchased a dozen brood sows at a public sale and brought them home. These sows were placed in a different feed yard, and gave birth to several strong litters of pigs. These pigs and sows thrived in excellent manner until about the first of June, when they were given the range of the old feed lot. Within two weeks after they had been turned into the cattle lot the pigs began to die, and within another two weeks all the pigs but 4 were dead. The old sows also became sick, but only 2 of them died, the balance passing through the attack.

This case goes to illustrate two important principles in relation to hog-cholera. One is that the virus of cholera is not entirely destroyed by the freezing weather of the winter months, and especially not so when left protected by a thick layer of mud and refuse. Under such conditions the virus will remain alive, although it may be less active than normally, and will attack new animals the following spring or summer.

The fact that the old sows did not all die, and did not become sick as quickly as the pigs, illustrates the fact that young animals are more susceptible to cholera than the older animals. Not only will young pigs more quickly take the disease, but the disease is also more virulent in these young pigs, and the death-rate among them is proportionately much higher than among the mothers.

Another incident that I recall serves to illustrate the importance of thoroughly cleaning and disinfecting pens after an outbreak of cholera if you desire to make the pens habitable for hogs the following year:

Two farmers, living in close proximity of each other in central Iowa, both had an outbreak of cholera on their farms during the summer of 1909. In both cases the epidemic was very severe, and wiped out the entire herd on each farm.

After the hogs were all dead, one farmer thoroughly raked up all the loose waste, cobs, old boards, litter, etc., in his lots and burned it. The pens and sheds were thoroughly sprinkled with crude carbolic acid and chlorid of lime, and the inside of the hog

house thoroughly coated with whitewash. This spraying and whitewashing was repeated at frequent intervals during the fall. In the early spring, after the snow had melted, he again thoroughly raked up the pens and burned everything in the way of refuse that was to be found. The pens were again treated with chlorid of lime, and a new bunch of hogs were then brought in from an adjacent county. These animals thrived first class in every respect, and raised litters of strong healthy pigs.

The neighboring farmer was not of the same industrious makeup as his neighbor, and allowed his pens to remain untouched during the winter, saying that the frost would kill out the disease. In the spring he also secured a number of brood sows and placed them in his pens. All went well for about three months, when his pigs began to die again, and by the end of summer his hog lots had again been swept clean by cholera.

This goes to show both the persistency of the germs of cholera, even through a cold winter, such as seen in Iowa, and also illustrates the effect of a little effort in the way of cleaning up in ridding premises of cholera.

PREDISPOSING CAUSES

In addition to this ultramicroscopic virus, which is the direct or active cause of hog-cholera, we have a large number of other factors which make the herd more liable to attack by the disease —that is, make them more susceptible to cholera—and these influences are known as accessory or predisposing causes. These are the conditions which cause the disease to appear in the herd of one farmer and not in that of another which may be locating in very close proximity to the infected farm.

These predisposing or accessory causes are many, among the most important of them being the following:

(1) **Age.**—Cholera is a disease which may attack animals at any age. Very young pigs may be attacked; in fact, it is not uncommon to have the virus of this disease attack the pigs while still unborn and in the uterus or pig-bag, with the result that they are all killed and the sow aborts or slunks the entire litter.

On the other hand, every farmer has observed that these old sows, while they may become sick, appear unthrifty for a consider-

able time, very frequently pull through the disease all right and recover. The same holds true with old boars. They are often not attacked at all by the disease, and, when so attacked, they also show a marked resistance to the disease and frequently recover.

It is a most constant observation that young shoats, young barrows, and young gilts are most early to show the symptoms of the disease, and also in this class of hogs the disease is most severe and produces the most severe losses. Young pigs when attacked by cholera almost invariably all die, or what few are left are so stunted as to be worthless, and are usually profitably knocked in the head.

As a general statement, then, it may be put down that hog-cholera may appear at any age, but that it is more likely to break out in a herd of young animals, and that the younger the animal, the more severe the outbreak, as a rule, and the higher the death-rate among the affected hogs. Old sows and old boars seem to possess a more or less strong resistance, both to the attack and to the severity of the symptoms, even when the disease does attack them. It must be remembered, however, that even old sows and old boars are often carried away by the disease. This is especially true in certain outbreaks of hog-cholera which appear to be especially severe and especially fatal, often sweeping the pens clear of every living hog in the course of a few days. This kind of an outbreak is especially likely to occur in newly settled districts and in localities where outbreaks of cholera have been absent for a number of seasons. In these cases it seems that when the disease is introduced or recurs that it is especially severe, and the herds melt away like snow on a hot summer day, and it is not unusual to find large numbers of animals dead in the course of forty-eight hours from the beginning of an outbreak on any given farm.

(2) **Sex.**—This also is to some extent a determining factor in the susceptibility of an animal to cholera. In the young barrows, young boars, and gilts sex seems to make little or no difference in the appearance of the disease. An acute epidemic of cholera appears to attack animals of male or female sex with equal frequency and equal severity. In the adult animals, however, the uncastrated male appears to be less susceptible to attack and more resistant to the disease if attacked. That is to say, they are less

liable to contract the disease, and, if they do develop cholera, they are less likely to die from the attack.

(3) **Pregnancy.**—To a slight degree pregnancy seems to protect the animal from attack, although a sow will often abort her litter without herself showing very marked symptoms of the disease.

(4) **Breed.**—This is a subject which has led to many long-drawn-out arguments among the exponents of the different standard breeds of swine. Each breed has enthusiastic followers, who believe that animals of that particular breed are less susceptible to cholera, but close investigation fails to show any marked resisting powers on the part of any particular breed. A few years ago breeders of the Mulefoot hog claimed to have found in this breed a type of hog that was proof against cholera, but stock raisers all over the hog-raising belt have found that these claims were exaggerated, and comparatively few of this type of animal are now to be found in the large hog lots of the Central West.

It has been fairly conclusively proved, however, that standard bred animals are more resistant to this type of infection than are the grade animals. This apparent resistance is in large measure no doubt due to the fact that standard bred animals are usually handled under better sanitary surroundings, owing to their higher cash value, and hence are not subject to as many opportunities for infection.

It has been my observation that Poland-China, Duroc-Jersey, Berkshire, Chester-White, and other standard types of swine appear to all be about equally lacking in immunity to the virus of hog-cholera, and animals of all these breeds may be found on funeral bonfires in our hog-raising communities during an outbreak of the disease.

(5) **Season.**—Cholera is a disease that may be regarded as present in certain regions of the United States at all seasons of the year, but there are certain parts of the year when the number of cases show a marked increase in number and when the disease seems to light up with renewed vigor. There are a number of reasons why this should be so, as I will attempt to explain:

About the first of May the gradual increase in cases usually begins, and this steadily creeps upward during the early summer, to reach a point in midsummer when the incidence of the disease

reaches its greatest height. In areas which have been free from the disease for a considerable period the outbreak is most likely to occur about midsummer, or early in the fall, and from the middle of July to the appearance of frost in the autumn the disease usually shows its greatest ravages in the great hog-feeding districts of the Central West.

With the coming of frost there is usually to be noted a dropping off in the number of cases, and this decrease progressively continues until midwinter, when the disease is usually at its lowest ebb.

This order of things, however, does not always obtain, and often some of the most severe outbreaks of the disease occur during the middle of winter. Outbreaks of this type are not generally widely distributed, and the epidemic is usually located in a small district, and does not have a tendency to assume the widespread proportions that characterize the midsummer outbreaks.

The reasons for this order of things are many. In the winter months a large number of the predisposing factors for spreading of cholera are absent.

For example, crows and buzzards, which play such a large part in the transmission of the infection to new herds at a considerable distance from the seat of the original outbreak, are not so numerous in the winter months, and especially not so in the northern section of the hog-raising district.

Running streams, which carry the infection down their banks from infected herds higher up their course, and cause the appearance of outbreaks in pastures through which they wend their way, are usually frozen during the greater part of the winter season, and hence the virus of cholera is shut off from another frequent avenue of dissemination.

Filthy hog wallows, which often prove to be hot-beds of cholera infection in the summer months, are also frozen and in disuse during the winter months.

Animals also are kept more confined for the greater part of the winter season, and hence do not have as great opportunity to come in contact with animals from infected herds. Close confinement, however, often means poor hygiene, bad air, and very frequently results in an outbreak of lung fever or pneumonia in a herd, which may be very severe in character and often mistaken

for cholera. The localized outbreaks of cholera that do occur during the winter months are very often due to lowered resistance on the part of the animals, due to the poor sanitary surroundings in which they are kept.

While no specific germ for hog-cholera has ever been definitely demonstrated, yet we are firm in the belief that such an organism does exist, and from what we know of other germs we are able to determine further reasons why outbreaks of cholera are less numerous in the winter season. Practically all germs are rendered inert and incapable of reproduction by cold, and especially by freezing. Many of them are entirely destroyed by prolonged exposure to cold. That this is true in the case of the hog-cholera virus would seem to be beyond doubt, and is unquestionably one of the important reasons why cholera is less common in the winter season.

In this connection, it might also be stated that repeated observations seem to bear out the idea that after a severe winter hog lots are frequently freed from cholera which had been infected during the previous season.

Another common factor in starting an outbreak of hog-cholera is the unearthing of bones and parts of carcasses of buried animals by dogs and other animals during the summer season. In the winter months, after the ground is frozen, this source of danger is removed.

There are, then, we find, many very good reasons why the outbreaks of hog-cholera are more numerous and more severe and widespread during the summer and early fall months. We must remember, however, that the disease may occur equally severe in winter, and in winter epidemics the danger from lung complications is, of course, more marked than during the summer months.

(6) **Geographic Location.**—This, a few years ago, might have been considered a factor in determining an outbreak of cholera, but at the present time cholera is so widespread throughout the herds in the United States that all parts of our country may be said to be equally well inoculated with the disease.

In practically every state where hogs are raised this disease has repeatedly ravaged the herds, and so widespread has become the scattering of these epidemics that no one state can hardly be regarded as a more pronounced cholera-infected district than

others. The disease is especially common in Iowa, Missouri, Indiana, Illinois, Nebraska, and Ohio.

(7) **Feed Lots.**—The sanitary condition of the feed lots is a most important factor in the predisposing causes for this disease. Hog lots that are kept clean, free from filth, well drained, properly fenced to keep out dogs and other animals, often remain uninfected, even when the disease is widespread in the surrounding territory.

Hogs which are kept in dirty, overcrowded feed lots, with poor water-supply, filled with muddy hog wallows, and allowed to feed upon carcasses of dead animals will not long remain free from cholera once the disease appears in the vicinity.

In many parts of the hog-raising belt every hog lot is provided with a wallow or pond, which is filled with dirty, stagnant water that becomes a literal hot-bed of infection by midsummer, and which often proves to be an incubating place for the germs of the disease during the winter months.

It is a hopeful sign to note that many farmers have come to recognize the danger of these insanitary hog wallows, and are now constructing sanitary concrete wallows which can be supplied with pure, fresh water every few days as needed.

During the summer of 1913, while engaged in the demonstration work for the United States Bureau of Animal Industry in connection with the eradication of hog-cholera in Pettis County, Mo., I had occasion to see a large number of farm feeding lots in which these insanitary hog wallows were maintained. In many instances these wallows were artificially formed simply by damming up a small run or watercourse in the ravine which existed between two ridges in the pastures. In this manner the water was dammed up in time of freshets and remained as a stagnant pool for many months, affording the hogs a filthy place in which to wallow, and providing for germs of all kinds, as well as for mosquitoes, an ideal place for breeding and multiplication.

These insanitary forms of hog wallow simply must go if we are to accomplish the success we deserve in the fight against cholera. Cholera is a preventable and an eradicable disease, but we must strike at all its hiding-places if we are to thoroughly conquer it and bring the hog-producing industry back on a safe plane.

An example of how these hog wallows are capable of harboring infection is to be seen in the following instance:

An outbreak of cholera occurred in the early spring on a farm in central Nebraska. The feed lot in which the animals had range was provided with a large pond or wallow, about 100 feet long by 50 feet wide. This pond usually contained about a foot of mud in the bottom and a like amount of water. During the outbreak of cholera on the premises the hogs affected by the

Fig. 41.—Hogs kept in an insanitary feed lot; such conditions are an open invitation to cholera. (B. A. I. Circular, No. 201.)

disease were very prone to seek relief from their feverish condition by burrowing in the cooling waters of the pond. The outbreak finally swept the pens clear, and not a hog was on the premises from June 1st to the latter part of December.

After the outbreak had rid the premises of hogs, the owner raked up all the loose cobs and other trash on the ground and a part of it was burned. The balance was thrown into the pond for the purpose of partly filling it up. The ground was then spread over with a thin layer of straw and over this kerosene was liberally

sprinkled. The entire mass was then set on fire and the surface of the ground thus thoroughly burned over. The result was a seemingly thorough disinfection of the premises. It did not occur to the man, however, that he was neglecting one of the most potent sources of danger in the hog wallow which was left untouched.

Late in December 10 brood sows were purchased and put in the pens, where they were carefully watched for a period of several weeks. As they appeared to thrive all right, 10 more were added early in February. These sows gave birth to several strong litters of pigs in the early spring and all thrived in first class shape until toward the last of April.

About this time the old pond thawed out, and when the weather got a little warm, along in May, the hogs began to wallow in the puddle. About the first of June several of the pigs were noticed to be sick, and within another two weeks several of the sows were showing typical evidences of cholera. The disease was soon in full swing again, and cleaned out over 80 per cent. of the herd. There can be little question that the infection was harbored through the winter in the mud at the bottom of the wallow.

Feeding pens should also be so arranged that it will not be necessary for the animal to dig his ration of corn or other grain out of the mud and dirt. Feeding floors of concrete or other material should be provided, so as to allow of feeding in such a manner that the hog may eat the grain given him without also eating an equal amount of mud and other filth in order to get it.

The hog is popularly believed to be a filthy or unclean animal. This is by no means true, except in so far as his surroundings make it impossible for him to be otherwise. No animal could keep clean in the insanitary, filthy lots that are so commonly provided for the use of the hogs. Carelessness in this respect has very often proved to be the cause of an outbreak of cholera which has cost the owner many times the amount a little improvement of his premises would have cost.

(8) **Water-supply.**—This is also a highly important factor in the prevention of an outbreak of cholera. Hogs which are forced to drink dirty, impure water cannot long remain well, and especially so when an epidemic of hog-cholera breaks out in the neighborhood. Hogs as well as men require a large amount of water, and

especially so in the summer months. This water should be equally pure for both man and beast. Water intended for the swine herd should be fresh, clean, and pure, and should be provided in clean, sanitary troughs, and not pumped into some mud-hole.

Water not only serves a useful purpose, and fills an absolute necessity in the metabolism of the animal's body, but a plentiful supply of clear, fresh water also serves to keep the body well washed out internally and free from disease-producing germs. A plentiful supply of pure water, both internally and externally, is an all-important essential in the promotion of health in either man or beast.

On many farms the water-supply for the animals, including hogs as well as cattle, is derived from some shallow stream which courses through the pasture or feed lot. While this is a very convenient source of supply, and eliminates the necessity for pumping, it is indeed not advisable.

In nearly all such cases this same stream runs through some other hog lot, or large numbers of them, higher up in its course, and receives the drainage from hundreds of hog pastures located on its banks. Let an outbreak of cholera occur on any of these farms higher up along the course of the stream, and it can be very readily seen what the outcome will be. The feces, urine, and other discharges of the sick animals containing the hog-cholera virus are washed into the stream, and by it carried along down its course to infect the herds for miles and miles.

Many epidemics of cholera can be traced in this manner from their source for miles along the water-course, herd after herd becoming infected by drinking of and bathing in the water of the polluted stream. Hogs when affected with cholera are usually burning up with fever and thirst, and will seek to relieve their symptoms by wallowing in water, and when a running stream passes through the hog lot they will almost invariably seek it, and lie down in the cooling water to gain relief from thirst and fever. It accordingly happens that they pass their highly infected discharges directly into the stream, from whence they are carried merrily along by the running waters to infect hundreds of other animals further along the course of the stream. Only too often the infected animals die in the stream or in close proximity to its

banks, and the decomposing dead animal tissue washes along with the waters, to be eaten by healthy animals in other pastures, and thus furnish the method of infection.

The dangers of these shallow running streams cannot be overestimated, and any benefit that may be derived from them in the matter of convenience is certainly more than overbalanced by the menace to health of the animals that they offer as a possible and even highly probably source of infection.

(9) **Food-supply.**—Here, again, we find a very active cause for outbreaks of cholera in herds which would otherwise have remained healthy. It has indeed been truly said that many farmers feed their hogs in such a manner as to lead one to believe that their object was to destroy the animal rather than to promote healthy growth and development with freedom from disease. Hogs are, fortunately, blessed with a remarkable resistance to adverse conditions, otherwise they would all die from poisoning and disease within the first few months of life.

Only too often the hog is used as the farm-yard scavenger, and is fed principally upon articles of food which are so filthy and decomposed that they would be refused by any other farm animal. Kitchen refuse, carcasses of dead animals, swill, hotel waste, decayed vegetable and animal matter, moldy grains, and rotten swill are only a few of the long list of food articles which the unfortunate hog is required to scavenger in order to obtain his daily bread upon the average farm.

Then, where kitchen swill, hotel and restaurant refuse, and like substances are used, the unwholesomeness of the food is almost invariably added to by the manner in which it is handled and fed. These refuse articles are collected in barrels, tubs, and cans, which are of the most filthy character imaginable, and which are never cleaned from one trip to another. In the hot summer months so abominable do these swill barrels become that the stench they emit in passing is almost unbearable. Can any animal be expected to remain healthy when fed under such circumstances?

In the large dairy districts the skimmed milk from the separators is often carelessly handled, and allowed to become a reeking mass of all kinds of infectious germs and loaded with poisonous toxins, before being hauled back to the farm and fed to the hogs. Not

only cholera but also tuberculosis finds its frequent origin in refuse matter from these creamery establishments.

There is another danger associated with the use of kitchen, restaurant, and hotel refuse, and that is the fact that this class of refuse matter very frequently contains considerable amounts of unused products from cured pork, such as bacon rinds, ham bones, rib bones, etc. It has been conclusively demonstrated that these scraps of animal tissue are often laden with the virus of hog-cholera which has not been destroyed even by the long process of curing through which pork is put in the modern meat-packing establishments. These infected remains of hog-cholera animals are often sufficient to introduce enough hog-cholera virus into a herd to form the starting-point for an outbreak of cholera.

During the summer of 1911, while stationed at Salt Ste Marie, Mich., the author had occasion to investigate, with the officials of the Canadian Department of Agriculture, an outbreak of hog-cholera which was then widespread over the province of Ontario. In this investigation particular attention was paid to the point of whether or not the infected herds had been fed on kitchen, hotel, and restaurant waste, and in a very large proportion of the cases this was found to be the case. In the course of this investigation the source of the outbreak, which was one of the most severe ever experienced in Ontario, was traced almost unquestionably to this source.

In Canada the government allows an indemnity for hogs slaughtered by inspector's orders, but in no case will this compensation be allowed where it is found that the owner has been feeding hotel or other kitchen refuse.

In many parts of the country hogs are fed upon the refuse or offal around slaughter-houses, and some of this offal almost invariably comes in part from animals which are affected with cholera. This often proves the source of an epidemic of the disease in the herds so fed, and, as slaughter-houses are very frequently located along the course of a small stream, the discharges from the sick animals are washed into the stream and carried along its course to infect other healthy herds often miles away.

(10) **Unbalanced Rations.**—This is also a frequent determining factor in the outbreak of cholera in a herd. Every hog has a more

or less well-marked resistance to the disease, and will not easily succumb to an attack by cholera germs if in good condition. Many farmers feed such an unbalanced ration, however, that the digestive tract of the animal becomes so deranged and the vitality so lowered that the animal readily falls a victim to the attack of the hog-cholera virus when it is introduced into the feed lots in some manner.

One of the best examples of an unbalanced ration, and also one of the most common, is the use of an exclusive corn diet. Many herds have been attacked by cholera within a few weeks after being placed upon a forced diet of corn, and in many instances the epidemic has been found to markedly decrease in severity when the food was changed.

An exclusive diet of this nature, confined to any one class of food substances, invariably produces indigestion, and this so alters the mucous membrane of the stomach and intestines that they are readily attacked by the hog-cholera virus. As we will find later on, the intestine is the most common point of entrance by this virus, and, if we are to prevent its successful lodgment there, we must use care to see that the digestive apparatus is kept right.

These are the facts which explain the statement so often heard in the hog-raising belt that the animals were all right until they commenced to feed corn, and then in a few weeks cholera broke out. I have heard this statement made hundreds of times by farmers whose herds had been attacked by cholera, and many of them believe that the corn itself contains some sort of germ which produces the disease. This is not the case. It is not the corn which is at fault, but the manner in which it is fed.

(11) **Disposal of Dead Animals.**—Herein lies one of the most important dangers in the spread of hog-cholera epidemics. If dead animals on the farms were all properly disposed of by burning within twelve hours after death there would be a most remarkable falling off in the number of hog-cholera cases within twelve months. More cholera is spread through neglect in this one matter than any other of the many factors responsible for cholera outbreaks and their spread.

It is all too frequently found to be the custom when any animal dies on the farm, be it hog, sheep, horse, cow, or what not, that it

is dragged out to the hog lot and left for the hogs to devour. The eating of the diseased meat in itself is sufficiently dangerous, and often results in the development of cholera when the carcass is that of a hog, but there are many other elements of danger connected with this practice that are usually entirely overlooked.

Wherever a dead animal carcass is exposed, there will buzzards and carrion crows collect to participate in the feast. These birds of prey will come for miles when they scent a feast of this kind. Often they come on to your premises from a similar feast miles away on the carcass of animals which have died of hog-cholera, and bring with them on their talons the remains of cholera-infected tissue, which are scattered in the feed lots to be eaten by the healthy animals there, with the invariable result that within ten to fifteen days an outbreak of cholera develops.

It is sometimes exceedingly hard to get the hog owner to see how his hogs can possibly become infected with hog-cholera from eating the carcass of a dead horse or a dead cow. The ox or the horse do not have cholera, and so could not contain the germs of hog-cholera. Hence, how could the hog possibly contract cholera from eating the carcass of these animals? This is the question they invariably ask. Now, all this is very true. Cows and horses and sheep do not have cholera, but it must be remembered that buzzards and crows will be attracted by a dead horse, a dead cow, or a dead sheep just as quickly as they will by a dead hog, and they are just as likely to have come directly from hog-cholera-infected premises a few hours before, and bring with them the virus of the disease, which they scatter over the premises. In this way healthy hogs are attacked and cholera breaks out.

Buzzards and Crows.—There can be no reasonable question but what this is the most common single method of introducing cholera into new districts. Buzzards and crows will often come from as far as one hundred miles to feast upon an exposed animal carcass, and bring with them the germs of hog-cholera. This is the most frequent explanation for the appearance of cholera in new districts where there seems to be no possible good reason why the disease should have appeared there.

It is a fact frequently noticed by the farmer that a few weeks after an outbreak of *chicken-cholera* on the farm it is followed by

an outbreak of hog-cholera. The explanation of this fact is often simple. The carcasses of the dead fowls are most frequently thrown out into the field or along the hedge fence to be eaten by other animals, and they also serve to attract to the farm the ever-watchful buzzard. With the buzzard comes the germs of cholera, and in a few weeks the hogs begin to die. It only takes a very small amount of reasoning to figure out the reason why.

Careless Farmers.—Some few farmers will be found in every locality who might well be classed as criminally careless in these

Fig. 42.—Turkey buzzard. One of the most active agents in the spread of hog-cholera. (Photo by Dr. Geo. R. White.)

matters, in that they will leave the carcasses of dead hogs, which they know have died of cholera, to lie and decompose in their fields, or in the roadways, and thus invite infection of their neighbor's herd. Such a farmer as this is a menace to his neighbors and should be made the subject of criminal prosecution. A man who will wilfully allow a stream to become polluted with the germs of hog-cholera, and thus endanger the herds of all the feeders further down the stream, is just as much a criminal as if he poured some poisonous chemical into the water, and the penalty should be equally severe.

Disposal of Carcasses.—There are two other principal methods of disposing of the carcasses of dead animals on the farm: One is by burial in soil and the other by burning.

The first of these is being found more and more unsatisfactory every year. It is almost always found to be the case that dead animals are not buried deep enough in the soil, and that prowling dogs, wolves, and other animals very frequently unearth them and bring portions of the dead animal tissue to the surface. Hogs will also root to a considerable distance when attracted by the odor of buried animal tissue. This not only brings the diseased tissues to the surface, and allows of their being eaten by the healthy animals, but it again serves to attract the ever-vigilant buzzard and crow, and these invariably bring with them the germs of infection and sow the seeds for an outbreak of disease.

Burning is the only satisfactory manner of disposing of dead animal carcasses, and this is only successful when properly carried out. Burning improperly done is just as ineffective as either of the other two methods mentioned above, and results in leaving a partially charred carcass to be feasted upon by animals and birds of prey.

In this connection, it might also be said that the practice of burying, if properly carried out, might be regarded as fairly satisfactory. The only proper method of burial is where the carcass is placed at least 6 feet under the surface of the ground and covered by 6 inches or a foot of quicklime and then with earth.

Burning, however, is so much easier and more efficacious than burial that it should be the universal practice. The burning of an animal carcass is a very simple process if properly carried out, and, on the other hand, is a most difficult one when improperly undertaken.

Proper Method of Burning Carcass.—When it is desired to burn a carcass or number of carcasses, as is often the case with hogs, secure one or two good logs or fence posts of a diameter of 6 or 8 inches. These are laid on the ground to form the framework on which the dead body or bodies are placed. In the case of hogs, 10 or 12 carcasses can be piled in a tier on a frame of the kind just mentioned. The posts or logs serve to keep the animals off the ground and allow of a continuous air draft beneath.

Incise the skin of the animals with a knife in several places, so that the grease will run freely when the carcasses begin to get hot. Pile some old wood, brush, and straw beneath the pile of dead bodies, pour a half-gallon of kerosene over the carcasses and wood, and apply a match. The wood and brush beneath will rapidly set the grease to running freely, and this will keep the flames fed until the dead bodies are entirely burned.

Carcasses burned in this manner will burn to a crisp, and there will be nothing left for dogs, hogs, buzzards, or other animals to feed upon.

(12) **Buzzards.**—The importance of these birds as carriers of hog-cholera germs and spreading of the disease over wide territories has already been mentioned, but I wish again to emphasize its importance. These birds are inveterate scavengers, and will travel miles and miles to attack a fresh animal carcass exposed in an open field or along the banks of a stream. They carry with them in their powerful talons portions of infectious material and animal tissue bearing the germs of the disease. These are scattered wherever they alight, and finally reach the stomach of the herds ranging in the field, with a resulting development of the disease in this new locality in a few days.

Stock owners often favor the destruction of the buzzards, but, if you will consider for a few moments, it is not the buzzard which is so much at fault after all. He is only performing the work for which he is intended. The fault lies with the stock owner who leaves exposed in his fields dead carcasses. Burn the dead animals, and the danger from buzzards and crows will be eliminated. Every dead carcass, be it horse, ox, hog, sheep, dog, chicken, or what not, should be immediately burned, and in this manner not only is the diseased carcass destroyed, but the danger from crows and buzzards is wiped out at the same time.

So many careless hog owners are to be found in every district that it would seem good policy to destroy the buzzard as a protection to their neighbors.

(13) **Dogs.**—These animals also prove frequently to be the means of carrying the disease from one farm to another. In every farming community there are a large number of dogs who wander about from one farm to another during the day, and which especi-

ally rove the fields in search of such food as they may find. Most of these animals are harmless, and at the same time worthless mongrels, with few redeeming qualities to warrant their being kept about the place.

These dogs are attracted by dead animal carcasses, and many of them seem to have a particular adaptability for ferreting out places where a carcass has been recently buried or improperly burned, and will dig up the bones and drag them away with them for half a mile or more, and carry them over into some other field and there devour the meat and gnaw upon the bones.

It frequently happens that the field to which the bones are taken is one in which a herd of healthy hogs are running. These healthy hogs devour the remains of the feast left by the dog, and thus become themselves infected, with the result that an epidemic of cholera breaks out in ten to fifteen days, and the farmer often wonders how in the world his hogs could have become infected. It is little things like this which often explain the cause of an outbreak where the owner has used every possible precaution to avoid exposure of his animals.

While riding over Pettis County, Mo., during the summer of 1913, I repeatedly found dogs crossing the road from an infected pasture, carrying with them a bone or other remains of some dead cholera animal, which was being dragged home by the dog to feed upon. Almost invariably within a few days I could count upon receiving notice of an outbreak of cholera on the farm which was the home of the dog.

Not only by dragging away portions of a dead carcass, but also by tracking on their feet infected manure and mud, dogs may prove to be the means of carrying the infection to a new farm. It must always be remembered in a cholera herd that the manure and urine of the sick animals is loaded with the hog-cholera virus, and carrying of this manure or mud with which it has been contaminated to your feed lot will infect your hogs and result in an outbreak of cholera on your farm. This is equally true, whether the manure be carried by your feet, the feet of a dog, on the shoes of a hog buyer or butcher, or by whatever means it may be carried. Always wash your shoes thoroughly before leaving a farm on which there are animals sick with cholera.

(14) **Chickens,** like dogs, are very frequently found to cross the road or dividing fences between one farm and another, and especially is this true if there be a hog lot on the next farm in close range of the chickens. In doing this the chickens carry on their feet large amounts of infected mud and manure if they go into a hog lot where cholera exists, and when they return to their home range they bring with them enough of the infectious virus to often cause the infection of any hogs which may be in their home lots. This would seem to be a very small matter, but it is just little things like this which enable the disease to spread so rapidly from one farm to another, especially in those districts where farms are small and hog lots close together.

(15) **Hog Buyers, Butchers, Etc.**—During the early part of an outbreak of hog-cholera, buyers, butchers, and traders usually become quite active in the effort to buy up at as low a price as possible all available animals which farmers, fearful of an invasion of their premises by the dread disease, may be willing to sacrifice. These dealers usually want to enter the pens and closely examine the animals of the herd, to determine in their own minds whether or not any of them are sick.

In many cases these traders and butchers come from a farm on which cholera is present, and bring on their shoes manure, mud, and other infectious material from the diseased pens. The result is that they carry hog-cholera on to the healthy farms and new herds become infected, with consequent rapid development of new areas of disease. Keep these men out of your hog lots. If they want to examine the hogs let them drive up alongside of the fence, and you drive the hogs out where they can see them.

Either do this or require them to thoroughly wash off their shoes before entering and after leaving the pens. It is a wise precaution to allow neither strange man nor animal to enter your hog pens. If you do this you will cut down a great deal of the danger of the cholera virus being carried to your farm from some adjoining or distant farm where it is present.

Many farmers carry their herds through an entire season of hog-cholera without a single sick animal appearing on their farm, while hogs are dying on all sides of them. In a great many cases the reason for this apparent good luck is to be found in the fact

that they keep everybody out of their hog pastures, and do not allow their hogs to run in a field adjoining the hog lots or pastures of their neighbors.

I have often heard it remarked in different localities that "Old Squire Jones" never loses any hogs with the cholera, because he is such a cranky old crab that cholera would not go near him. In most cases this "Old Squire" is just enough of a crank that he won't allow any stranger to enter the pens where his hogs are feeding, and kills any stray dogs that he may find frequenting his place. The result is that he places a barrier to the entrance of cholera upon his premises, and his hogs escape, while those of his neighbor are dying by hundreds.

(16) **Newly Purchased Hogs.**—Every farmer should make it a rule never to add any newly purchased animals of any kind to his regular herds or stables until they have been isolated for at least thirty days, and closely watched for symptoms of any disease which might be transmitted to the regular stock on the place. This is a rule that may be very profitably followed, not only with respect to hogs, but also with regards to cattle, horses, and sheep as well. A regular pen, paddock, or stable should be provided for this purpose, and used whenever any new live stock of any kind is brought on to the farm.

During the winter months hogs are often purchased for breeding purposes at public sales, or from some other farm miles distant, and brought to the home farm and placed immediately in contact with other animals of the herd. These newly introduced swine may have been recently exposed to cholera, and, if so, will develop the disease in the course of a couple of weeks, and spread the disease to the entire herd.

On the other hand, the newly purchased animals may be themselves free from disease, but may have come from an infected feed lot, and carry upon their feet infectious material which serves to introduce the hog-cholera virus upon the farm. New purchases should be put through a dipping tank before being admitted to the feed yards or any regular pens.

Not uncommonly the purchased animals will have recently had an attack of cholera, but are now apparently getting well again. These hogs, however, often discharge hog-cholera virus in

the feces and urine for several weeks, and will infect other healthy swine very quickly upon being brought in contact with them.

(17) **Exhibiting at Fairs.**—Hundreds of valuable hogs are lost every year, and hundreds of large breeding farms infected, through infection with cholera contracted by show animals while on exhibition at county and state fairs.

In these expositions large numbers of swine from all parts of the country are brought together and placed in close contact with each other. Almost invariably some animal on the grounds will prove to be infected, and it does not take long for the germs of cholera to become diffused throughout the animals comprising the exhibit, with the result that a few days after arrival home from the fair the show hogs begin to droop, and in a few days a well-developed outbreak of cholera is in full swing upon the premises.

All animals which are intended for show purposes should receive the immunization treatment, preferably the serum-simultaneous method being used, thus rendering them immune to an attack of the disease even if exposed. If this is not done they should at least be shut up in separate pens upon arrival home, and kept so isolated for two or three weeks until all danger from infection has passed.

(18) **Interchange of Boars.**—Very often an epidemic of cholera is transmitted from one farm to another through an exchange of boars. In a large number of communities it is a common practice for several farmers to club together and buy a standard bred boar for breeding purposes. This animal is rotated from one farm to another for a few weeks' stay at each place throughout the year. If one of the farms upon which this boar performs service is the seat of an outbreak of cholera, or has recently been an infected premises, the boar may either become sick with the disease or he may merely carry the infected manure and dirt with him to the next farm, and thus start up an outbreak of cholera.

Boars, before being changed from one farm to another, should be put through the dipping vat, and then should preferably be kept isolated for a week or ten days before being admitted to the herd.

(19) **New Cattle and Sheep.**—On large stock farms several carloads of cattle and sheep are brought on to the premises every year from the large stock markets of the country. In many cases these

cattle are shipped from the large stock yards in cars which have been recently used for the shipment of hogs which may have been infected with cholera. It also frequently happens that these cars are not thoroughly cleaned and disinfected before being reloaded with cattle. As a result of this practice the cattle come on to the place bringing with them infected manure and bedding from these cars. It naturally follows that within a few days there is an outbreak of cholera among the hogs in these feed lots.

In many instances the same loading chutes are used at smaller stock-yards for cattle, sheep, and swine. These chutes and pens are practically always infected, and the result is carrying of hog-cholera virus by the cattle and sheep which pass through them on to the feeding farms. Cholera invariably will result from such practices, and thousands of animals die as a result of this form of neglect every season.

It should be remembered that the loading pens and chutes of public stock-yards are practically always infected, and that any animals passing through these pens will carry the infection with them to their new pastures.

Stock cars are always a menace to animal health unless they have been thoroughly disinfected after each unloading. It is a wise practice, and one that should be always insisted upon, to have cars thoroughly cleaned and disinfected before loading them with cattle, sheep, swine, horses, or any other animals that are to be taken back to the farms for feeding purposes. Hog-cholera is only one of many diseases which may be transmitted by this means of infection.

(20) **Driving Hogs On Public Roads.**—When cholera makes its appearance in a herd it is the common practice to ship out all those animals at once which are of marketable size and which do not show marked symptoms of the disease. In many communities it is the practice to take the hogs to the loading yards by driving them along the public road. This should never be allowed, and especially should it not be allowed in the case of swine where there is any likelihood of cholera being present.

Frequently sick shoats will die along the route, and nearly always there are one or more sick animals in the lot, and these are distributing infectious manure and other discharges along the road-

way, where it is easily picked up by other live stock and carried into a feed lot.

Hogs should always be hauled to market in tight-bottom wagons, and the litter used in these wagons should not be carelessly swept out along the public roadway, as is often done, but should be carefully gathered up and burned, thus destroying all infectious material.

If we are ever to control hog-cholera in this country we must give attention to every possible detail that furthers the dissemination of the disease, and wipe out every avenue of spread of the infection, both by education of those who do not appreciate the danger, and exercise of police powers in the case of those who don't seem to have any regard for their neighbor's welfare.

(21) **Threshing Crews.**—In the country districts it is the common practice for farmers to exchange help during the threshing season. This is a most convenient practice, and one that is to be approved, but unless care is taken it will mean spreading of cholera from farm to farm by the threshing crew.

I very distinctly remember a few years ago, in western Illinois, visiting a farm where a threshing crew was at work. The threshing machine was located in the hog lot. And, by the way, this is very frequently where the threshing is done, and the straw pile so placed as to afford a shelter for the hogs in the winter months.

At this particular place which I chanced to visit there was an outbreak of cholera, and about fifty yards from the threshing engine two boys were engaged in digging a deep trench in which they were preparing to bury half a dozen dead pigs which had died during the previous night. Dozens of men and teams were tramping about in this infected hog lot, gathering up infected manure and litter on their feet and conveying it to their own farms, to become the source of starting an epidemic of the disease in their own feed lots. None of these men realized the dangers to which they were exposing their own herds. It is highly essential that the farmers be brought to understand the dangers attending such practices, in order that they may avoid carrying cholera to their own premises and thus endangering their herds. Often the course of an epidemic can be traced along the route of a threshing crew with nearly every farm infected.

(22) **Intestinal Parasites.**—Due no doubt to the gross irregularities practised in feeding, and the notoriously poor quality of food given to hogs on many farms, the hog is very prone to become affected by intestinal parasites, and especially by worms. The hog seems to be able to bear infestation by large numbers of these worms without producing any very severe symptoms. There can be no doubt, however, that the presence in the bowels of these unnatural tenants cannot do otherwise than lower the vitality of the animal and render them more susceptible to attack by other diseases.

Cholera is especially a disease of the bowels, and the inflammation of the mucous membrane lining the bowel by these parasites undoubtedly makes it more easy for the virus of hog-cholera to gain a foothold and start up the process of change that finally results in formation of the typical ulcers of hog-cholera.

I have repeatedly noted, on postmortem in hog-cholera outbreaks, the presence of large numbers of worms in the bowels of the dead animals. On the other hand, we find a large number of animals with enormous numbers of worms who do not have cholera. There is a wrong impression held by many farmers that worms cause cholera. This is not true. The worms themselves are not capable of causing cholera, and neither do I believe that worms carry the infectious virus from one animal to another. They do, however, undoubtedly lower the general health of the animal, and especially do they tend to lower the vitality of the bowels, and make them more susceptible to invasion by disease germs of any kind.

When, to the presence of worms, we have added the additional factor of gross improprieties and irregularities in feeding, such as feeding of decomposed swill, moldy grain, etc., it cannot be otherwise than true that the hog so abused is especially inviting to an attack by the cholera virus. It is in these debilitated animals that the disease first gains its foothold in a community, and then, by passage through the body of the living hog, the virus gains increased power, and attacks more vigorous animals, and finally becomes a widespread epidemic which sweeps away herd after herd in its wake.

(23) **Disinfection of Premises.**—When an outbreak of cholera

has taken place on a farm it is important that the premises should be thoroughly disinfected before other healthy animals are brought on the farm and placed in these pens. I have frequently seen cases where an outbreak of cholera had occurred on a farm and all the animals had either died or been sold. The farmer then went to a distance of several miles and bought healthy hogs, brought them home, and turned them into these infected pens. Such a practice is practically equivalent to signing the death warrant of the newly purchased stock.

The sick hogs previously upon the premises have left behind them their virus-bearing discharges, and, unless the pen has passed through a process of freezing during a severe winter season, the newly arrived hogs will begin to show signs of being off feed in a few days, and in about fifteen days will begin to die.

It should be made an invariable rule to thoroughly clean up all litter and refuse, such as corn cobs, wood, etc., and destroy same by burning. Wallows should be drained out and thoroughly cleaned and the entire pen disinfected before any new animals are admitted to the premises.

(24) **Previous diseases** from which the animal may have suffered are often important factors in relation to its susceptibility to cholera.

Hogs which have once had the disease will rarely get a second attack. In some cases they do, but it is the exception rather than the rule.

Brood sows that have been through the cholera are usually highly prized by breeders, on account of the fact that it has been noted that pigs born from these immune sows rarely are attacked by the disease, at least until after weaning. This may be said with equal positiveness in the case of pigs born from sows that have been immunized against cholera by use of the serum-simultaneous treatment. Pigs in this class of herds are usually immune from attack by the disease until after they have been weaned.

This temporary immunity is no doubt due to the fact that there is some substance contained in the milk of the mother which acts as a protective agent in preventing the young from an attack of the disease.

Other diseases which may prove of importance in determining

an outbreak of cholera on a farm are affections of the respiratory and digestive tracts. The importance of intestinal worms has already been mentioned, and in a general way what has been said about worms holds good in the case of other conditions.

Hogs which have been suffering from diarrhea, bronchitis, and similar diseases are in poor condition to resist and overcome an attack of cholera, and, accordingly, easily develop the disease if it makes its appearance in a neighborhood.

(25) **Miscellaneous Factors.**—In the preceding pages all the important predisposing factors in causing an outbreak of cholera and promoting its rapid spread have been discussed. There are still a few minor points which may be mentioned.

For instance, small rodent animals, such as rats, mice, woodchucks, squirrels, skunks, and rabbits, often carry the infective virus hog-cholera from one farm to another. Rats particularly are frequent inhabitants of hog yards, and these animals have a marked tendency to migrate from one farm to another if food supply becomes low. By close association with the sick hogs and infected premises they have ample opportunity to acquire and transmit infection on their paws, bodies, and nests.

On many farms more than one herd of hogs are kept, and the herds may be in widely separated parts of the farm, but very frequently the same person cares for, feeds, and waters both herds. In such instances as these it can be very readily seen how easy it is for the feeder to carry the infection on his boots or shoes from one part of the farm to another.

It should be made an invariable rule to always wash the shoes or boots off thoroughly before going from one herd to another in a different part of the farm, and especially so if there is any sign of disease in either feed lot.

Not infrequently in pastures located along the course of a large railroad infection takes place in rather curious ways. Cars passing over the railroad route carrying infected hogs invariably result in the deposit along the roadbed of varying amounts of infected manure and litter. This litter and manure, in the form of dust, may be carried by wind over into the adjoining pastures, and form the basis for an infection of the herds feeding in these fields.

In other instances a railroad wreck may take place, and a large

number of hogs escape from the cars and wander into pastures located in the surrounding fields. Officials of the railroad company are usually very prompt to arrive on the scene, and offer to make settlement for any damage done to fences, pastures, or growing crops. Don't be in too big a hurry to estimate the extent of your damage in these cases. Wait a few weeks and see if your herd develops cholera. It very frequently happens that these hogs which escaped from the damaged cars are suffering from cholera or come from infected cars, and carry cholera upon your premises, with the result that your final damage, instead of being a few dollars, runs up into the thousands.

I very distinctly recall an incident of this kind that occurred in the western part of Indiana a few years ago. A train wreck took place along the route of one of the large trunk railways, and several carloads of cattle were derailed. A number of the cattle escaped, and made their way through or over fences into pastures adjoining the railroad right-of-way. In this case also the railroad adjuster was promptly upon the ground, and made what appeared to be liberal settlements with all farmers where any damage had been done, and received in return their signature to an affidavit releasing the railroad company from all claim for damages.

Now it so happened that these cattle originated in the section of the United States where Texas fever is present, and they carried on their hides large numbers of the ticks which produce this disease. The result was that a few weeks later cattle on the farms surrounding the scene of accident began to die, and it was found, when veterinary surgeons were called, that the disease from which they suffered was none other than Texas fever. The final loss ran up into thousands of dollars and resulted in a protracted legal battle in the courts. Don't be in too big a hurry to settle these damage claims. Wait a few weeks, and see just how extensive your damage is before making any complete release of the railroad company.

SUMMARY

We have now found the following facts to be true as to the causes of hog-cholera:

(1) The disease has both a direct cause and a number of indirect or predisposing causes.

(2) The direct cause is some sort of a virus, which is so very small that we are unable to find it even with the most perfect microscopes.

(3) There are a large number of predisposing causes which act as aids to the hog-cholera germ or virus in getting a foothold in a herd, and in spreading it from one herd to another. The most important of these predisposing causes are—

Age.—Young animals being particularly susceptible.

Sex.—Male animals being slightly more resistant to cholera than the female.

Breed.—No breed has a perfect immunity to cholera. Mule-foot hogs regarded as very resistant. Pure breed animals less often attacked than the crossed breeds. Too close inbreeding might also be mentioned as a factor which tends to decrease the disease-resisting powers of the animals and makes them more susceptible to cholera.

Season.—Cholera being especially a disease of the late summer and early fall months, frosts of winter usually check its spread.

Geographic Location.—Cholera attacks herds in all parts of the world. Found in all parts of the United States, and appears almost equally severe in all localities. Illinois, Iowa, Indiana, Ohio, and Missouri are especially the seat of extensive yearly outbreaks of cholera, with consequent enormous losses.

PATHOLOGY AND POSTMORTEM DIAGNOSIS OF HOG-CHOLERA

The changes produced in the tissues of the sick hog by the virus of hog-cholera are very widely distributed throughout the body and vary greatly in different cases, but in a general way may be regarded as more or less constant. In some cases there are very marked changes produced in the organs found in the thoracic cavity—that is, in the lungs and heart—while in other cases the changes in these organs are comparatively slight, and are replaced by very extensive lesions in the organs of the abdominal cavity. Still other carcasses are found in which there are very marked changes in both the thoracic and abdominal viscera.

In taking up the lesions of hog-cholera it is best to begin systematically with the skin, and describe the changes found in each important organ as we proceed from the skin inward in a thorough examination of the carcass.

RULES FOR MAKING POSTMORTEM EXAMINATION

When called to view the carcass of an animal that has died from any unknown cause, and it is desired to make a postmortem examination of the case, the following rules will be found very convenient to follow:

Remove the carcass to some convenient open space, preferably to some point where it can be immediately burned after the postmortem examination has been completed. There is much less chance of scattering infectious material by moving the carcass before it is opened than in moving it afterward. This is an important consideration, when we consider the danger of further infecting pens and pastures with the hog-cholera virus, and thus increasing dangers for the remainder of the herd.

The dead body is now laid on its back and, preferably, thoroughly douched with an antiseptic solution of some kind. Good solutions for this purpose are 1 : 2000 bichlorid of mercury, 1 : 500 carbolic acid, or a solution of some of the coal-tar antiseptics or disinfectants, such as the common hog dips, or, most preferable of all, the liquor cresolis compound. Add just enough of this solution to a pail of water to give it a bluish, soapy appearance, and then thoroughly douche the carcass and the ground beneath and around with the solution. A second pail of solution should be provided for washing knives and other instruments used in the examination.

With the carcass on its back, examination should first be made of the external appearance of the skin, especially in the axillary region just inside the front legs, in the flanks, around the ears, on the snout and eyelids, for the appearance of reddening of the skin, which is a common finding in this disease.

LESIONS IN THE SKIN

As just stated, the lesions found in the skin consist of a reddening, which may be due to a simple dilatation of the blood-vessels (hyperemia), or there may be genuine hemorrhages into the skin,

with the formation of permanent discolorations. If these hemorrhagic spots are very small and pin-point in appearance they are classed as petechial hemorrhages. The large red blotches commonly seen in severe cases are known as ecchymotic hemorrhages.

Fig. 43.—Severe congestion and hemorrhages beneath the skin in hog cholera (H. K. Mulford Co.).

Distinction can be made between the redness due to simple dilatation of the blood-vessels (or hyperemia, as it is pathologically known) and that due to hemorrhage by simply pressing upon the reddened areas. If the reddening is due to hyperemia the blood

is forced out of the vessels by pressure and the redness disappears. In those cases in which there is a genuine hemorrhage, with escape of the blood from the vessels due to their rupture, pressure does not remove the blood, and hence the redness does not disappear on pressure.

In these cases, if we were to examine the tissues from the skin under the microscope we would find in the one class of cases—those due to hyperemia—that there was simply a marked dilatation and enlargement of the blood-vessels, which are filled with large amounts of blood. There is in these cases, however, no escape of blood from the blood-vessels into the surrounding tissues.

On the other hand, in the hemorrhagic cases the microscope shows us a different picture. The blood-vessels of the skin in these cases are not only markedly dilated and engorged with blood, but in many cases the pressure has become so great that the vessels have given way under the strain, and there is a rupture of the vessel wall, with the escape of the blood-cells into the tissues surrounding the blood-vessels. In this sort of change the redness produced is permanent in character and cannot be removed by pressure.

The location of these reddened areas on the skin is widely different in each individual case. In some cases it is practically impossible to find any reddened spots on the skin at all, especially after death, as those spots which are due to simple congestion tend to disappear after death. In other cases almost the entire skin is reddened and spots of normal colored skin are difficult to find.

However, there are certain locations of the skin where these changes are most apt to be found, the following being the most commonly involved:

(1) *The Ears.*—The skin of the ears is one of the earliest spots in which the red discoloration tends to appear. In addition to the red coloring the ear also has a tendency to become markedly swollen and edematous or dropsical, due to the collection of a fluid in the tissues under the skin.

(2) *The Eyelids.*—The skin of the eyelids, and especially the upper lids, are also early involved in the changes produced, and become reddened and swollen.

(3) *The Axilla.*—This is the fold of skin extending from the inner side of the foreleg to the wall of the chest. This skin is very

thin and thinly covered with hair, and, accordingly, has a tendency to quickly show the presence of any abnormal discoloration. Either hyperemic or hemorrhagic lesions may be found in this location early in the disease.

(4) *The Flanks.*—Here, too, the skin of the animal is comparatively thin, and offers a good surface for the appearance of the skin lesions of cholera. By drawing the hind legs backward and outward the skin is placed more on the stretch, and the changes become more readily visible to the naked eye.

(5) *Snout and Muzzle.*—These are also favorite sites for the reddened skin lesions of cholera, and here, as in the case of the ears, there is usually considerable swelling accompanying the discoloration of the skin.

(6) *Under Surface of Belly.*—In a well-marked case of cholera there is usually a considerable amount of discoloration of the skin along the under surface of the belly. This may take the form of reddish spots, sprinkled here and there along the belly, or there may be a diffuse redness, involving practically the entire surface of the skin.

(7) *Lateral Surfaces and Back.*—These are among the last locations to show the skin discolorations, due to the fact that the skin in these regions is much heavier, the amount of fat more pronounced, and the blood-supply less marked. In many cases, however, the skin of the back and the sides of the carcass, as well as that of the ears, axilla, flanks, and belly, is liberally sprinkled with reddish spots of discoloration, which here, as in the other regions, may be either of the hyperemic or hemorrhagic type.

In this connection it may be stated that the skin lesions of cholera are, of course, more difficult to make out in the carcass with the hair on than in those carcasses which are inspected in the packing houses after the hair has been removed by the scalding process. It is not practical, however, in making the regular routine postmortem to have the dead bodies scalded and the hair removed. White hogs show skin changes much more pronounced than black breeds.

In connection with discoloration of the skin it must not be forgotten that there are many other possible causes for reddening of the skin besides cholera. For instance, there may be a number

of discolored areas due to frost-bites, especially of the tips of the ears. Reddening may take place from the presence of many skin diseases, such as mange or urticaria. Simple dragging of the belly on the ground, or the irritation produced by traumatic injuries in stumpy pastures, also produces reddening of the skin, especially along the belly surface. In noting the presence of areas of redness due consideration must be given to these other possible causes as well as the probability of their being due to cholera.

LESIONS IN THE LYMPHATIC GLANDS

Having completed the examination of the skin, we now take the knife and make an incision from the inner side of the foreleg down along the neck to the angle of the jaw on the same side. This incision, if correctly made, will open to view the chain of lymphatic glands known as the cervical glands, as well as the large gland located at the angle of the jaw, known as the submaxillary gland.

In hog-cholera there is a special tendency for hemorrhages to take place into the substance of these glands. As a result, we find that the cut surface of the gland, which is normally of a clear grayish-pink color, becomes reddened and even black in color. This discoloration may appear as a number of diffuse pin-point-like red spots—petechial hemorrhages—or it may take the form of a diffuse redness of the entire gland.

The gland itself is also considerably larger than normal, due to swelling, and there is noted also a marked softening of the gland substance.

If we were to examine this gland in microscopic section we would find that here, as in the skin, we have an enormous dilatation of the blood-vessels, with, in many cases, a complete rupture of their walls and the escape of their contents into the gland substance. In many cases where there has been a very large amount of hemorrhage into the gland tissue, it is practically one mass of blood-clot. In other cases we only find the small areas of hemorrhage scattered throughout the substance of the gland.

In practically every case the microscope will show a marked enlargement of the individual cells which go to make up the gland, and these cells will be found to be in a marked condition of degeneration with commencing death. In stained sections the individual

cell is found to be swollen, the cell is granular and stains poorly; the nucleus of the cell is pushed to one side and broken up into fragments.

Other Lymphatic Glands Involved.—These glands, which are exposed with the incision from the axilla to the angle of the jaw, are only a small part of the entire glandular system, and we will find, as we proceed further with the postmortem examination, that practically all the important lymphatic glands are similarly involved.

Inguinal Glands.—If we next make an incision through the skin in the fold of the groin, we will expose a chain of superficial lymphatic glands—the superficial inguinal glands—and these also will usually be found to be markedly involved in the pathologic process. Here the changes are practically the same as in the cervical glands just described, consisting in the appearance of hemorrhagic spots throughout the gland, accompanied by marked swelling and softening of the structure of the gland.

Fig. 44.—Swollen and congested mesenteric lymph-glands seen in hog-cholera (H. K. Mulford Co.).

Mesenteric Glands.—When we open the abdominal cavity and take out the intestines we will find in the mesenteric chain of lymph-glands, located in the fat just above the coils of small intestine, a marked hemorrhagic appearance, due to the same series of changes just described under the cervical and submaxillary glands.

Sublumbar Glands.—Buried in the fat in the sublumbar region or loin we find another chain of lymphatic glands, several in number, on each side. These are easily exposed from the inner surface by an incision into the fat, and they are also found to share in the disease changes and are spotted with hemorrhage.

Precrural Lymph-gland.—Incision on the inner face of the hams reveals, buried in the fat in front of the ham, a large lymph-

atic glands, producing well-marked discoloration. The color of the coal-dust particles, however, is decidedly different from that due to hemorrhage. In such cases also there is absence of other signs of acute inflammation, such as swelling, softening, and degeneration of the tissue of the gland. Under the microscope the appearance of the two forms of discoloration are entirely different, and no mistake should be made in this direction.

LESIONS IN ABDOMINAL CAVITY

After having made the incisions for examination of the cervical and submaxillary glands, and the second incision in the inguinal fold to examine the superficial inguinal glands, an incision should be made in the median line of the belly to allow of examination of the abdominal organs. This incision goes through skin, subcutaneous tissues, and through the peritoneum, thus opening up the abdomen. Care should be used that the knife does not penetrate too deeply and open into one of the bowels, which are often distended with gas and pushed right up against the belly wall. This incision should extend from the margin of the anus to the midline of the neck.

Pulling the sides of the abdominal incision apart, we are able to get a view of the contents of the abdomen. Frequently we will find that the cavity contains a considerable amount of a blood-colored fluid which is formed as a result of the overfilling of the smaller blood-vessels in the abdomen, causing fluid and blood-cells to pass out into the empty peritoneal space.

The Intestines.—The intestines, or bowels, are now taken out through the opening in the belly wall and examined. In severe hemorrhagic cases we can frequently see blood-stained areas shining through the outer coat of the bowel, and especially so the small intestine. Also in many severe cases the large bowel will be found to be discolored very markedly, in fact, to have an almost black appearance. This is due to the severe type of bowel inflammation which is often an accompaniment of cholera.

We will now proceed to examine the different parts of the intestinal tract in order, beginning with the stomach.

The Stomach.—This organ frequently shows, even on its outer surface, a markedly congested and reddened appearance. On

cutting into it we find the inner lining very frequently spotted with hemorrhagic areas of various sizes. As in the skin, these may be so small as to almost escape notice, or may be quite large and prominent. In many cases there is a severe inflammation of the entire stomach (gastritis) and a diffuse redness of the entire lining mucous membrane.

It is also a very common occurrence to find in the stomach a large number of worms. These are in no way a part of hog-cholera, but may be of importance in so far as they possibly lower the vitality of the animals, and render them more susceptible to attack by the cholera virus.

Many authors do not mention it, but I have very commonly found the typical button-like ulcers in the membrane of the stomach. These are small spots in the mucous membrane, which has been eaten away by the disease process, and which is covered over on the surface with an elevated cap or scab. If this is brushed off with the back of the knife a typical ulcerated surface will be found beneath. I have in my museum collection several specimens of ulcerated stomach taken from hog-cholera cases, and in post-mortem examinations in the field I have found them to be of quite common occurrence.

The Small Intestine.—We next examine the small intestine, which begins at the stomach and terminates at the junction of the ileum with the large bowel. This portion of the bowel is divided into three parts. That part immediately attached to the stomach is known as the duodenum, and is not usually very markedly involved in the lesions of cholera. In some cases, where there is a generalized inflammation of the intestines accompanying the disease, the inner surface of the duodenum will be found reddened, and in occasional cases ulcers will be found.

The second portion of the small bowel, the jejunum, lies between the duodenum and the ileum, which is the third and principal portion of the small intestine. This part of the bowel also shows no typical lesions beyond a diffuse redness where an inflammation of the bowel exists, and in some few cases a scattering of ulcers may extend into this part of the bowel.

The ileum, or last part of the small intestine, which includes the last several feet of the small bowel before it empties into the

cecum or head of the large bowel, is the most commonly and the most pronouncedly affected of all the small intestine.

The nature and extent of the lesions in the ileum will vary greatly with the type of disease. As has been stated in previous pages, we frequently meet with cases in the field in which there is absolutely no visible changes whatever in the bowel, and in which the mucous membrane of the bowel has a clear, smooth, velvety appearance and no signs of disease whatever. It is usually in these cases that we find the more marked involvement of the organs of the thoracic cavity and especially of the lungs.

In a general way, cases of hog-cholera can be divided into those of the acute and chronic types. The acute cases are those which attack the animal with very severe onset, pursue a very rapid course, and produce a fatal outcome within the first few days. In this

Fig. 45.—Bowel ulcers of hog-cholera. (Photo by Dr. Geo. R. White.)

class of cases the lesions in the intestine, and especially the ileum, are more likely to be of an acute congestive type, with numerous pin-point or larger red spots in the mucous lining and even the outer covering of the bowel, or there may be a severe generalized inflammation of the bowels, with an angry red appearance of the entire lining membrane of the intestine.

There is another type of cholera which perhaps is the more common, in which the onset is less severe, the symptoms develop less rapidly, and the animal lingers for several days or even weeks before death takes place. In this type of cases we see an entirely different appearance in the small bowel, and especially in the lower portion of the bowel or ileum.

The typical bowel lesion in these chronic cases is the button-like ulcer which stands up above the surface of the inner lining of the bowel as a dark-colored, wart-like elevation. When this crust

This valve is known as the ileocecal valve, and is of particular importance in the postmortem examination of hog-cholera carcasses. This valve derives its particular importance from the fact that here is the most frequent source of the cholera ulcer. Ulcers appear at this point when they are not to be found in any other part of the bowel. Just why this should be so is hard to explain, but the fact remains that there is no other one location where the button-like ulcer is so commonly found as on the ileocecal valve.

Method of Ulcer Formation.—It is interesting to note just how these ulcers form. In the normal bowel there are located beneath the lining membrane little collections of lymphatic tissue, known as lymph-follicles. These are of two kinds: viz., single or solitary lymph-follicles—the so-called solitary follicles—and larger patch-like collections, consisting of several of these solitary follicles collected together. These are known as the agminated follicles, or better known as Peyer's patches. In the duodenum there are found another group of lymph-glands known as Brunner's glands. These, however, are rarely affected by the cholera virus.

When the animal becomes infected by the virus of hog-cholera, it appears that the germ has a special liking for these lymphatic glands in the walls of the intestine, and they burrow there and enter the gland structure. It seems most probable that the germs then multiply in the gland substance and thus increase in number. By their presence and also, no doubt, by the action of the poisons which they produce they set up an inflammatory reaction in the gland substance. This results in an increase in the number of gland cells. This increased number of gland cells presses upon the small blood-vessels supplying the gland, and the result is that the blood-supply is shut off. Any tissue or portion of tissue shut off from its blood-supply soon must perish, and, as a result, these tissues die. At the same time the enlargement of the gland pushes the surface upward, and the dead tissue is raised into the lumen of the bowel, giving the characteristic button-like appearance. These ulcers are usually invaded by a second germ, known as the necro-bacillus, which aids in the destruction of tissue.

In the course of a few days or weeks, if the animal is not destroyed by the disease, the slough separates and there remains a

crater-like, ulcerated base. This gradually heals, and the destroyed gland tissue is replaced by white fibrous tissue, leaving a shiny scar or cicatrix. This is the appearance in the healed cholera cases, a small punched-out scar marking the location of the former ulcer.

The Colon.—We will next have a look at the large bowel or colon, and also the cecum. The cecum is the sac-like beginning of the large bowel into which the ileum opens, the opening being guarded by the ileocecal valve, which has already been described.

In the cecum we frequently find an extensive inflammation, with marked reddening of the mucous membrane lining this portion of the bowel. Here, also, we may find ulcers, some of those found in this portion of the bowel being quite large, and often will show a well-marked elevated surface and button-like appearance.

The colon in some cases is little affected, if at all. On the other hand, many cases show a most violent inflammation of this portion of the large bowel. In many cases the inflammation here is so severe that the bowel appears almost gangrenous, and all the coats seem involved in the inflammation.

Some authors seem to convey the impression that ulcers in the colon are unusual in cholera. I have found this decidedly not the case. Many of the most pronounced ulcers I have ever seen were in the large bowel, and I have found them here in many cases in which there were no ulcers to be found either in the small bowel or on the ileocecal valve.

As regards the severity of the inflammation of the large bowel, I have noted it as an almost constant finding that when the large bowel is involved it is apparently much more severe in type than that of the small intestine. In many cases the congestion of the large bowel is so marked that the organ is very dark red or almost black in color when taken from the abdomen, and it requires no opening of the bowel to reveal the character and extent of the lesions. The ulcers also in this part of the intestinal tract seem to have a marked tendency to burrow deeply and involve the mucous, submucous, and muscular coats more extensively than those which are found in the small intestine.

For some reason, however, there is often no corresponding severity of the symptoms of the disease as related to the extent of the pathologic changes. Cases which clinically have been appa-

rently mild in character often show a most severe type of inflammation and ulceration of the bowel.

The Spleen.—The next organ to be examined is the spleen, or milt. This organ is located in close relation to the posterior

Fig. 47.—Inner coat of large bowel in hog-cholera, showing congestion and ulcer formation (H. K. Mulford Co.).

wall of the stomach, and in the hog is normally about 6 inches long, 1 to 2 inches wide, and $\frac{1}{2}$ inch thick. It is of a bright scarlet color in health and rather flabby to the touch. The spleen is a peculiar organ, the functions of which are rather indefi-

nite. However, it seems to play some part in the resistance of the body to infections, and in all the acute infectious diseases it is the usual rule to find marked changes in this organ. This is the case not only in swine, but holds equally true in practically all species of animals and in man as well.

So in hog-cholera, which is undoubtedly an acute infectious type of disease, it is only reasonable to expect to find marked changes in the spleen. It is found on examining the spleen, especially in those cases which run an acute course, that there is marked enlargement and swelling of the organ. The entire spleen is engorged with blood, and when examined with the hand will be found to be quite softened and pulpy in consistence.

On cutting into the substance of the spleen it is found that the normal scarlet or pink color has disappeared, and, instead, the organ appears darkened and congested. There is often a considerable accumulation of decomposed blood in the organ, and this drips from the cut surface as a dark almost tar-like fluid.

If we prepare a portion of the spleen for microscopic examination and, after proper staining, examine under the miscroscope, we will find that there have been marked changes in the minute structure of the organ. The normal splenic pulp has been largely replaced by a broken-down collection of destroyed gland cells and disintegrated red blood-cells. The blood-vessels in the organ are dilated and engorged with blood. There is pouring out of blood-corpuscles in enormous numbers into the surrounding splenic pulp, and the entire picture is one of very pronounced and severe degeneration and destruction.

In some cases the congestive changes in the spleen are not so marked, and we have instead more of a parenchymatous degeneration of the organ, with swelling of the individual spleen cells; the nucleus of the individual cell is crowded to one side, the cell bodies show numerous small albuminoid granules throughout their substance, and the entire cell stains poorly with the ordinary stains. In many cases there appear in the center of the cell small droplets of fat, which have commenced to form as the result of beginning fatty degeneration.

These marked changes in the spleen would seem to point very strongly to the conclusion that hog-cholera is a germ-produced

disease, and, accordingly, properly classed among the infectious diseases. It is, indeed, unfortunate that all efforts up to the present time have failed to demonstrate conclusively the exact definite germ which produces the disease. More extensive work, however, is being done every year, and workers in every government, state, and college laboratory are making every effort to locate the exact cause of the disease, and it seems but a question of a short time until some one of these workers will discover the elusive organism which has so far baffled every effort to locate it.

Changes in Mesenteric Glands.—In connection with the examination of the intestines it would seem well to again call attention to the examination of the chain of mesenteric lymphatic glands. These glands are several in number, and form a row or chain across the width of the mesentery which serves to anchor the intestines to the abdominal wall. Normally, these glands are of a light gray or pinkish color. In cholera they become much enlarged, swollen, and decidedly discolored, as the result of hemorrhage into their substance.

Changes in the Liver.—There is a remarkable absence of any very pronounced visible changes in the liver in a great percentage of hog-cholera cases. The organ is often considerably swollen and somewhat paler or more yellowish in appearance than normal, but there is by no means the extensive series of changes in this organ as a result of the infection that we might expect from the severity and character of the disease.

As a general rule, it may be stated that the liver is increased in size, is somewhat swollen in outline, the color is more pale than normal, with a tendency to be yellowish, especially if there be any marked biliary obstruction or inflammation of the bile-ducts accompanying the disease. The organ is less firm than normal, and cuts much easier with the knife than does the healthy liver. Examination of the cut surface of the liver frequently shows it to be bathed in a bloody fluid, and, when this is scraped away with the back of the knife, we find that the normal markings of the liver are somewhat obliterated and the organ has a peculiar mottled appearance.

There is also usually a more or less marked discoloration of the tissue, due to the obstruction offered to the free escape of bile

from the liver. This obstruction is sometimes quite marked and accompanied by a genuine catarrhal jaundice, with discoloration of the entire body, due to the absorption of coloring-matter from the bile and deposit over the entire carcass.

If an examination be made of a stained section of the liver under the microscope it shows changes here very similar to those which were found in the spleen, but not nearly so well marked or severe. The individual liver cell is markedly swollen and stains poorly with the laboratory stains. The nucleus of the cell is often fragmented, and quite a number of cells are found in each lobule which show complete destruction. The blood-vessels at the center of

Fig. 48.—Hog-cholera kidney, showing turkey-egg spotting. (Photo by Dr. Geo. R. White.)

and around the margin of the lobule are dilated and filled with blood, with here and there a blood-clot or thrombus seen in the blood-vessel.

In some of the cases with high fever there is, in addition to this parenchymatous degeneration, a well-pronounced fatty degeneration of the liver. In these cases fat-droplets appear within the cell, and the entire appearance of the liver is greasy and yellowish, the cut surface often dripping an oily, fat-like fluid when cut across with the knife.

Changes in Kidneys.—It is in these organs that we find the greatest uniformity of lesions and the most constant presence of changes typical of the disease. There are no other organs in the

body which are so constant in appearance in both the acute and chronic forms of the disease as the kidneys. The condition of these organs, then, may be regarded as of the highest importance in the making of postmortem diagnoses.

When we remove the kidney from its fatty bed in the sublumbar region we note, as a rule, that the entire organ is much larger than

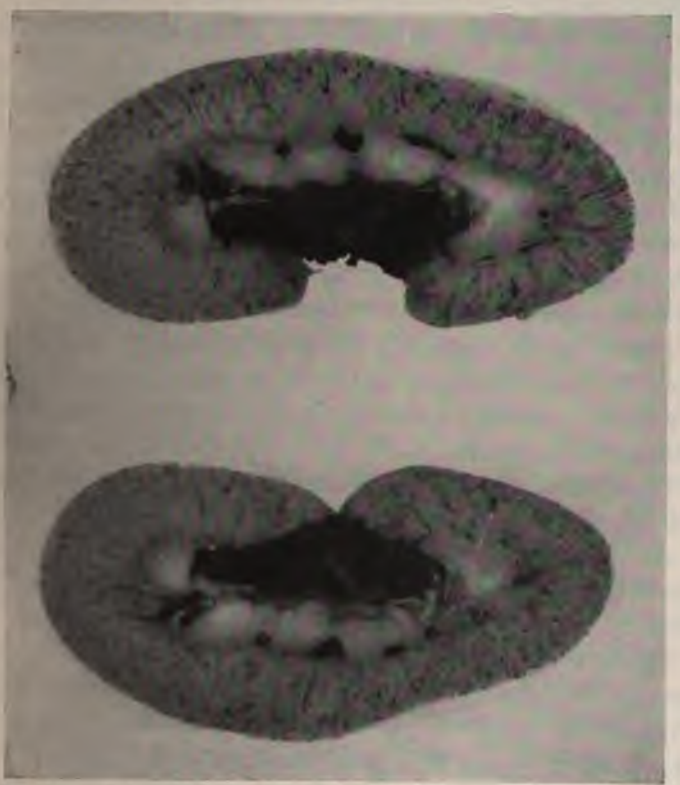

Fig. 49.—Hog-cholera kidney, showing hemorrhagic spotting. (Photo by Dr. Geo. R. White.)

normal. This is especially true in the cases of acute cholera. Very often one kidney will be much more involved than the other and much more enlarged. I have seen numerous cases in which one kidney was nearly double the size of the opposite organ. In addition to being larger in size, the outline of the kidney is swollen and somewhat bulging in appearance.

The color of the kidney is usually darker than normal, being often very dark, almost chocolate in color. When we pick the kidney up in the hand and examine it, we also find that it is much softer than the normal healthy kidney, which is quite firm. When we look at the organ closely we are immediately attracted by a very peculiar and characteristic pathologic finding. This consists in the appearance on the surface of the organ of a number of small pin-head-like spots of a reddish color. These shine through the serous covering or capsule of the kidney and give a very typical appearance. These spots may be very few in number and require careful search to demonstrate them, while in other cases, especially those of the acute type, we may find the organ literally riddled with these spots, giving an appearance not unlike that of a turkey egg.

If you take the knife and strip off the capsule of the kidney, and wash the surface in clear water, it will make these spots stand out much more plainly and make them very evident. As to color, they vary from a bright red dot to a dark colored, almost black spot. They are found all over the outer surface of the kidney, and we will find when we cut into the organ that they are also liberally sprinkled on its inner surface.

These spots are small pin-point hemorrhages, which are designated, pathologically, as petechial hemorrhages. They are in every respect the same as the petechial hemorrhages which were described under the head of Skin Lesions. They are very typical in appearance and once seen will never be forgotten.

These petechial hemorrhages are formed in the following manner: The blood-vessels of the kidney are very small in size especially the vessels in the outer two-fifths or cortex of the organ. On account of their small size these vessels are very easily stopped up, and when the virus of cholera circulating in the blood reaches the kidneys it collects in these small capillary vessels and results in their occlusion or stoppage. As a result, there is a stretching and rupture of the delicate vessel wall and blood escapes into the substance of the kidney. These small spots on the surface are merely the reflection shining through of these cortical hemorrhages in the substance of the kidney.

When we take the knife and cut into the kidney, we find that the organ is much softer than normal, and cuts very much

easier than does the healthy kidney. We also find that the organ is very friable and crumbles up if squeezed firmly in the hand. The cut surface of the kidney is bloody and drips a reddish-colored fluid. If this is washed away, and we examine the cut surface of the kidney, we find that it is markedly swollen and bulges, due to the increased tension produced by the marked engorgement with blood. When we examine the surface after thoroughly washing away the blood we find that these same pin-point spots which were noticeable on the outer surface are prominent here also in the outer portion of the surface.

Now, if the necessary laboratory facilities are at hand, and sections for examination with the microscope be prepared, a very beautiful appearance is shown under the microscopic lens. The tissue shows very plainly the results of engorgement and degenerative changes In the outer or cortical portion of the kidney we find the small clumps of blood-vessels, known as the glomerulus, very markedly engorged with blood and hemorrhagic. The tubules are also swollen so much that the lumen or canal is entirely closed. The individual lining cells are also greatly changed. They stain very faintly and appear more like shadow cells under the microscope. The nucleus of the cell is badly broken up, and the entire picture shows the effects of severe changes produced by the disease.

In the canal of the tubules we find dead cells, clots of blood, and casts of various kinds. Red and white blood-cells are common, and fibrinous plugs, due to hardening of the fibrinous exudate, pour out from the overfilled vessels.

Changes in Bladder.—The urinary bladder will usually be found to contain a large amount of urine. This urine is high colored and usually has a cloudy and, not infrequently, a somewhat bloody appearance. The odor is also quite strong in the majority of cases. If we cut into the bladder wall and allow the urine to escape, and then turn the bladder walls inside out, we find a very noticeable change in a great number of cases. Normally the inner wall of the bladder is a clear white or grayish color, with no blood-vessels or red spots to be seen. In the organ taken from cholera carcasses we usually find, especially in acute cases, the spotting of the inner mucous lining with numerous small pin-point-

examinations in cases which gave a history of prolonged illness, with all the usual symptoms of chronic cholera, but in which post-mortem examination revealed absolutely no ulceration in the bowel. Diagnosis in these cases was based on the findings in the kidney, and injection of blood from these animals into healthy pigs produced typical cholera, so that there can be no question that the disease was cholera; yet, with a long-drawn-out course, there was an absence of bowel ulcers. Accordingly, we cannot insist on finding ulceration of the bowels to pronounce a case cholera. It must be remembered that we can have cholera, and cholera of the very worst form, with no ulcers in the bowels, and also very little apparent bowel disturbance, such as diarrhea.

Changes in Testicles.—These organs are seldom involved in cholera in young uncastrated males. Occasionally in old boars the testicles and scrotum swell up during the course of the disease, and it is not uncommon in these cases to have the animal rendered worthless for breeding purposes as a result. The swelling of the testicle destroys its power to secrete, and often closes the tube or duct which leads from the testicle to the urethra.

In connection with the use of serum injections in the male animals it should be borne in mind that there is always danger of causing a swelling of the scrotum and testicles if the serum be used in that region. For this reason, it is advisable not to inject the serum in the hams in boars, but rather to inject in the subcutaneous tissues just behind the ear. Observance of this point will save the serviceable value of many high-priced breeding animals.

Other Changes in Abdominal Cavity.—We have already considered all the important organs in the abdominal cavity. After the organs have been removed it is well to examine the deep lymphatic glands—that is, the sublumbar, precrural, and iliac. The location of these glands and the character of the changes found have already been described under the head Lymphatic Gland Involvement.

In connection with general examination of the abdominal cavity it may be noted that the peritoneum—the shiny serous lining of the abdomen—has lost its bright, glistening appearance, and shows a tendency to be dark, dull, and lusterless. It rapidly discolors when exposed to air, and the entire carcass rapidly decomposes.

This tendency to early decomposition can be noted even before the body is opened. The carcass always shows a rapid bloating, and when the abdomen is opened, even though the animal be dead but a few hours, there is usually an escape of very foul-smelling gas.

LESIONS IN THORACIC CAVITY

It is well now to open the thoracic cavity and examine the organs therein for changes produced by the disease. There are two or three ways of opening the thorax, any one of which may be followed. The thorax is a sort of bony box, formed by the ribs, breast-bone, or sternum, and spinal column. In young pigs and small shoats a sharp knife will cut through the ribs readily about 2 inches at either side of the breast-bone where the bony and cartilage portions unite. In older animals this is not so easily done, and it is usually better to split down the middle of the breast-bone or use a small bone saw to saw the ribs about 6 inches on either side of the sternum. In this manner a window-like piece of meat and bone is removed and the underlying organs exposed. The most important viscera in this part of the body are the lungs and the heart. We will examine the heart first and then the lungs.

Lesions in the Heart.—When the heart is removed, it will usually be found to be somewhat softer and more flabby than normal, and close inspection will show that it is somewhat lighter in color, due to the degeneration of the muscle by the poisons of the disease.

At the upper margin of the heart we find two small triangular flaps, resembling very much the ears of a dog. These normally have a clear, shiny surface, but in severe cases of cholera we find these auricular flaps, or auricular appendices, as they are properly designated, studded with small dark-red hemorrhagic spots, similar to those which we found in the skin and in the kidney. These hemorrhages in the heart are not present in a very large percentage of cases, but when present are decidedly characteristic.

When we cut into the heart we find that the muscle does not offer as much resistance to the knife as ordinarily it should, and the muscle lining of the heart is dull in color instead of the normal shiny appearance. It is not unusual to find the cavities of the heart filled with large blood-clots, especially the right

but these are not characteristic of cholera, as are the hemorrhagic spots just spoken of.

Microscopic examination of the heart muscle usually shows about the same changes that were found in the spleen, liver, and kidneys. The cells are pale and indistinct, the individual cells are broken up and fragmented, and here and there are seen evidences of beginning fatty degeneration, due to the action of the toxins of the disease upon the tissue. In cases of acute hog-cholera the pronounced weakness of the animal and death are in a large measure due to the severe action of the poison of the germs upon the heart muscle, weakening its power so as to reduce the force of the circulation and also finally producing rapid heart failure and death.

Changes in Lungs.—Here we find the greatest variation of lesions of any part of the body. So widely different are the changes produced by cholera in the lungs in different cases, in different epidemics, and in widely scattered sections of the country that it has led to many heated discussions among veterinary authorities as to whether or not it is the same disease which produces these widely dissimilar appearing lesions.

Up to a few years ago the classification was generally made into two diseases—hog-cholera and swine plague. The name hog-cholera was applied to that disease which made itself manifest by pronounced changes in the abdominal cavity, with inflammation and ulceration of the bowels, while the name swine plague was applied to that disease which showed marked lesions in the thoracic cavity, especially in the lungs, and few if any lesions in the bowels.

A few years ago one of the leading veterinary pathologists of this country investigated a number of cases of supposed cholera, which showed very pronounced symptoms and lesions in the thoracic cavity and few if any changes in the bowels. He believed this condition to be other than cholera, and designated it an infectious pneumonia. His theory has since been practically abandoned, as it has been shown by repeated experiments that blood taken from animals suffering with this so-called infectious pneumonia, and injected into young shoats, will produce a form of the disease showing typical lesions in the bowels, kidneys, and spleen as well as in the lungs.

With regard to the disease known for years as swine plague, it may be stated, in a general way, that this name as a separate disease has been almost entirely abandoned. It is no longer regarded as a separate, distinct disease, as it has been also shown in these cases that if we take the blood from an animal which is supposedly suffering from swine plague and inject it into young pigs, we just as often produce a disease showing all the postmortem findings of the regular type of cholera as we do one one showing the lesions of swine plague.

We are, accordingly, forced to the conclusion that we have but one disease to deal with—namely, hog-cholera—but that it may manifest itself largely as an infection of the organs of the abdominal cavity or, on the other hand, may involve principally the lungs, and have more the appearance of a pneumonia.

Typical Lung Lesions.—The typical findings of cholera in the lungs do not greatly differ from those found in other parts of the body. Here, as in the skin and kidneys, the lesions have a marked tendency to assume a hemorrhagic form, and in such cases they appear as a diffuse scattering of dark-red spots over the surface of the lungs. One lung only may be affected, or both may be involved. In many cases only a portion of the lung may be spotted. In these slight lung involvements it is more common for the dorsal surface of the posterior lobe to be the most markedly spotted with hemorrhage. As in the skin and kidneys, these hemorrhagic spots vary in size and may be very small or quite appreciably large. They are usually, on an average, about the size of a pin-head and rather dark-red in color. When the lung is cut into with the knife it is found to be quite congested with blood, and the cut surface is covered with a bloody, frothy exudate.

This is the picture found in an uncomplicated case of cholera affecting the lungs. In actual postmortem work such a picture as this is rather the exception than the rule. In most cases the lung involvement is quite different from this, and is much more like a pneumonia than cholera. In fact, where there are marked lung changes it is nearly always the rule to find with the cholera lesions a complicating pneumonia.

In those cases which show a pneumonia the lung is firm, swollen, and has lost its elasticity. There is no longer any air in the

pneumonic portions, and when cut it is found to be solid, resembling

Fig. 50.—Lung showing bronchopneumonia. Hog died of subacute cholera (H. K Mulford Co.).

very closely liver. This is the common finding in cholera where lesions in the chest are extensive, and when this postmortem

picture is found, with no ulceration of the bowels, and no spots in the kidneys, it is often hard to make a diagnosis between the two diseases, cholera and pneumonia.

However, if we examine closely, we will usually be able to find a few hemorrhagic spots in the kidneys, and also perhaps in that portion of the lung not involved in the pneumonia changes. In some cases the signs of cholera are so few, and the appearances in favor of pneumonia so strong, that it is necessary to resort to laboratory tests with the blood, and injection of the suspected blood into healthy susceptible pigs in order to arrive at a diagnosis. Often examination of the carcass of a second animal from the same herd will reveal changes more typical which will enable us to clear up the diagnosis.

Other Lesions in the Thorax.—Closely associated with the lungs we have the lymph-glands of the thoracic cavity, especially important being the bronchial and mediastinal glands. In cholera these glands share in the hemorrhagic lesions described in the other lymphatic structures of the body. The hog-cholera virus appears to have a special tendency to attack the lymphatic glands and produce severe hemorrhages in them. Accordingly, we will find these glands swollen, discolored with blood, and, if examined under the magnifying powers of the microscope, with dilatation of the blood-vessels and clotting of the blood outside the ruptured blood-vessels.

The pleura, or lining serous membrane of the chest cavity, is also usually the seat of quite marked change in severe involvement of the thoracic cavity. There is a loss of the normal shiny appearance of this membrane, and it becomes dull and opaque, resembling very much in appearance a tarnished mirror. Beneath its surface we find frequently small pin-point-sized areas of discoloration. In some cases these are very marked, and the membrane is freely dotted with hemorrhage. These genuine hemorrhages can be readily distinguished from blood accidentally spilled on the pleura, as by cutting a small vein. If it is simply spilled blood, it can be readily washed off with water, while, if it be due to genuine hemorrhage into or beneath the pleura, it remains after washing, being within the tissue rather than upon it.

CHANGES IN BONES

The changes already described are about complete as far as the usual field postmortem examination goes. In the large packing houses, however, where the carcasses are split after the viscera have been removed, we frequently see another very interesting postmortem lesion. This consists in a very pronounced hemorrhagic discoloration of the bones forming the spinal column. Normally, the split surface of these bones is of a whitish-gray color or, at most, a slight pink. In well-marked cases of cholera the hemorrhagic discoloration is so marked that the entire cancellated structure of the bone has a dark-brown and often black color.

This discoloration may be sometimes noted in other bones of the body as well as in the spinal column, but it is more often and more pronouncedly seen in this location than any other part of the body.

CHANGES IN BRAIN AND COVERINGS

It is rather unusual to examine the brain, the spinal cord, or their coverings in a hog postmortem, but in those cases where this is done they are frequently found to participate in the general hemorrhagic changes. There is usually a congestion of the coverings of the brain and cord, and often hemorrhagic areas are found on the surface of the brain when it is removed from the body cavity.

SUMMARY

In preceding paragraphs there has been presented a detailed discussion of the important postmortem findings in a case of hog-cholera, and an effort will now be made to summarize the important facts in these findings for quick reference and review. The following are the cardinal points in postmortem diagnosis of cholera:

(1) *Skin.*—Here should be noted the presence of redness, which may be either in the form of scattered pin-point-like hemorrhages or a diffuse redness. It is most common and most marked on the ears, the skin inside the forelegs, the flanks, and the under side of the belly. Both hemorrhagic and hyperemic redness are found.

(2) *Lymph-glands.*—The changes in these glands consist of marked discoloration, varying from a bright red to dark, almost blackish, discoloration. The important lymph-glands are all swollen, softened, and discolored. Those most commonly exam-

like red blotches, similar to those that were found in the kidney a skin. The underlying blood-vessels are all overfilled and dilat and we can trace their course as bright red, wavy lines. T mucous membrane around the opening of the ureters or tubes tl lead from the kidneys to the bladder is usually markedly swol and pouting in appearance.

These changes in the kidney and bladder, and especially th in the kidney, are highly diagnostic, and should always be lool for. The small red spots in the kidney are about the most f quently found of all the postmortem lesions of cholera; tl is, these changes occur with greater frequency than any other sin finding. Ulcers on the bowels are not always found; many ca show no swelling of the ears or discoloration of the skin; but t vast majority of cases will show these hemorrhages in the kidn The number of spots present will vary, as stated, from a very fe in some cases, to hundreds, but in nearly every postmortem so spots in the kidney can be found if carefully looked for. Th is no other disease of swine in which these same dark-red spots the kidney are common, and so their presence is of the utmost i portance in making a diagnosis in cases where hogs are beginn to die of some unknown disease.

During the past winter I have examined many postmort cases shipped from surrounding country districts in which diagno could not be made from the symptoms present. In these case often find at the commencement of an outbreak that there no ulcers in the intestine, very little discoloration of the lymph glands, no changes in skin, very little change in spleen or liver, l almost invariably the examination of the kidney shows the prese of the tell-tale turkey-egg apotting. I have often venture diagnosis on the finding of these spots alone, and I have yet to se case where subsequent developments did not bear out the diagno As a postmortem finding I consider the lesions in the kidney far and away the most important single finding.

Many stockmen and veterinarians have come to associ cholera with ulcerations of the bowel. Now this is quite tru chronic cholera, but it must be remembered that in the ac form of cholera intestinal ulceration is often entirely abs I would also like to say that I have repeatedly made postmort

examinations in cases which gave a history of prolonged illness, with all the usual symptoms of chronic cholera, but in which post-mortem examination revealed absolutely no ulceration in the bowel. Diagnosis in these cases was based on the findings in the kidney, and injection of blood from these animals into healthy pigs produced typical cholera, so that there can be no question that the disease was cholera; yet, with a long-drawn-out course, there was an absence of bowel ulcers. Accordingly, we cannot insist on finding ulceration of the bowels to pronounce a case cholera. It must be remembered that we can have cholera, and cholera of the very worst form, with no ulcers in the bowels, and also very little apparent bowel disturbance, such as diarrhea.

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Lesions in the Heart.—When the heart is removed, it will usually be found to be somewhat softer and more flabby than normal, and close inspection will show that it is somewhat ligher in color, due to the degeneration of the muscle by the poisons of the disease.

At the upper margin of the heart we find two small triangular flaps, resembling very much the ears of a dog. These normally have a clear, shiny surface, but in severe cases of cholera we find these auricular flaps, or auricular appendices, as they are properly designated, studded with small dark-red hemorrhagic spots, similar to those which we found in the skin and in the kidney. These hemorrhages in the heart are not present in a very large percentage of cases, but when present are decidedly characteristic.

When we cut into the heart we find that the muscle does not offer as much resistance to the knife as ordinarily it should, and the inner lining of the heart is dull in color instead of the normal bright, shiny appearance. It is not unusual to find the cavities of the heart filled with large blood-clots, especially the right side,

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ined are the cervical, submaxillary, inguinal, mesenteric, sublumbar, precrural, iliac, bronchial, mediastinal, presternal, and prescapular. Of these, the most accessible and most important are the cervical, submaxillary, inguinal, and mesenteric.

(3) *Stomach and Bowels.*—In the stomach we find redness, and not infrequently one or several typical cholera ulcers. Worms are also commonly found, but are of no importance.

In the intestine in acute cholera there may be absolutely nothing found except a diffuse redness, such as we would expect to find in any acute inflammation. The chronic cases are the ones in which are found the marked ulcerations which are so commonly associated with cholera in the mind of the general public. It must not be forgotten, however, that we may have typical cases of cholera, and that it may be cholera of the very worst type without any ulceration in the bowel whatever.

When ulceration is present the most frequent location is the lower portion of the ileum. Next in frequency is the ileocecal valve. However, the large intestine is not free from tendency to become the seat of ulcer formation, and may frequently prove to be more involved than the small bowel.

(4) *The Spleen.*—This organ is swollen, enlarged, darkened in color, softened, and filled with blood.

(5) *The Liver.*—The changes here are, commonly, enlargement, swelling, softening, and degeneration.

(6) *The Kidney.*—In the kidney there is seen enlargement, swelling, softening, degeneration, and the presence of the diagnostic turkey-egg spotting, especially in the outer portion of the organ. These lesions are the most constant of all the postmortem findings of cholera, and are of exceedingly marked importance in the postmortem diagnosis of the disease.

(7) *The Bladder.*—Here the characteristic findings consist of overfilling and dilatation of the blood-vessels under the lining membrane, and petechial hemorrhages which show up as pin-point-like red spots on the inner lining of the bladder after it has been cut into and turned inside out.

(8) *The Heart.*—The changes in the heart are essentially hemorrhagic, and consist especially of prominent dark-red spots on the auricular flaps, with perhaps discolored areas beneath the lining

membrane (endocardium) and sometimes beneath the external covering (pericardium).

(9) *The Lungs.*—The findings here are very unreliable in character. In some cases we have merely petechial hemorrhages beneath the pleura, which appear as pin-point-like dots of discoloration. In other cases we may have all the lesions of a typical pneumonia, with consolidation of the lung, absence of air, and all the usual changes described under pneumonia. In these cases, especially where abdominal lesions are slight or absent, absolute diagnosis is difficult without experimental injection of healthy young animals.

(10) *The Bones.*—The changes in the bones, while rarely observed in the regular postmortem made on the farm, are none the less interesting and characteristic. There is no other condition in which the hemorrhagic changes in the bones are quite so prominent and well marked, and on the meat-inspection floors of our large packing houses the hog-cholera spine is commonly observed.

INCUBATION PERIOD OF CHOLERA

Definition.—By "incubation period" is meant the length of time which it takes for an animal which has been exposed to the disease to begin to show signs of being sick. The number of days which it will take for an animal to get sick will differ quite a good deal in each case, depending upon the amount of resistance the animal offers against the disease, the number of germs entering the body, and the virulence or disease-producing power of the germs present in this particular outbreak of the disease.

Some hogs seem to take the disease very, very easily, and it takes only a small amount of virus or germs to get the disease started in a herd of this kind. This is very likely to be found the case in young animals, and in those hogs who are run down for any of the reasons which were mentioned under Predisposing Causes. In a hog that is in a run-down condition the germs of cholera have an unusually easy time once they get into the body. They breed quite rapidily, and it is only a short time until there are enough of them present to cause the animal to show signs of being sick. It is in cases like this, where the herd is made up of young shoats, or where, for any reason, the health of the animals is rather poor

to begin with, that we get a short incubation period. In some cases of this kind the symptoms of disease show up very quickly, and it is sometimes possible to note signs of sickness within three or four days after exposure. It is quite unusual, however, to have many cases where the cholera symptoms are plain before the fifth day.

The amount of virus or germs which enter the body of the animal is also a most important matter in causing symptoms of sickness to appear rapidly or later on. If there is only a small amount of exposure, as from scattering of virus in the feed lot from the feet of a commission man or hog buyer, who may be riding about the country going from one feed lot to another without properly cleaning his shoes, and carrying manure and mud from feed lots where there are sick hogs to other pens in which the hogs are still healthy, it will take longer for the animals to get sick. In these cases there is only a very small amount of virus present, and it will take quite a while for the germs to multiply in large enough numbers to make the animals sick.

On the other hand, if we have hogs that are shipped in cars which have been used for shipping cholera hors, and have in this way been infected, we will not have to wait long for signs of the disease to appear. This also is true in cases where healthy hogs are fed with the dead bodies of hogs which have died of cholera. In such cases as these the well hogs take into their bodies a large amount of disease-producing virus, and it takes only a short time for them to get sick.

Another way by which hogs may get the disease and get sick very quickly is by placing them in pens that have been occupied by cholera hogs only a short time before. For instance, if a farmer buys a drove of healthy shoats at a public sale, and brings them home and places them in pens or a feed lot in which he has lost hogs from cholera a few weeks or months before, it is very likely that these new hogs will get sick before he has had them on the place a week. The reason for this is that the pens have been filled with virus from the manure and urine of the animals which died there, and the germs are present in large numbers ready to attack any healthy hogs that may come into the lot.

Virulency of the Germs.—In some years the virus of cholera seems to be very much more severe, and makes a much more rapid

attack than in other years. This is spoken of as virulency, and the virus which is capable of making an animal sick in a very few days is commonly called highly virulent. In some seasons we see the hogs getting sick in a very few days after they have been exposed to cholera, while in other years it takes the disease a long time to get started in the herd. Often the incubation is so long that the owner will think that his herd has entirely escaped the disease. Just about the time he begins to feel pretty good about it, however, he will note that one or two shoats are off feed and do not seem to care to move about much. This is a pretty sure sign that something is wrong, and in one or two more days cholera is well started in the herd.

Usually the first few weeks after cholera makes its appearance in any community the period of incubation is quite a little bit shorter than it is later on in the summer or fall. This is probably due to the fact that the disease-producing power or virulence of the germ seems to gradually weaken toward the end of the season. It is also quite likely that during the summer several of the herd are repeatedly exposed to small doses of virus, and, while they do not get sick, they do develop a certain amount of protective power against the disease, and, when later on they are exposed to a large number of the germs, they are able to put up a stronger fight against the disease before they give up and get sick.

It has also been commonly found by men who have worked a great deal with cholera that the hotter the summer may be, the shorter time it requires for the exposed animals to get sick. It has also been found by those who have paid attention to the outbreaks that occur during the winter months that the colder the winter, the more quickly cholera will develop, and animals get sick in just a few days. This short incubation period in cold winter months is no doubt due to the fact that in very cold weather the hogs tend to pile up more and get in closer contact with each other. In this way it makes it easier for the germs of the disease to get from one hog to another and set up the disease. The extreme heat lowers vitality of the herd and hastens development of cholera.

Many very interesting examples of how this incubation period may differ are commonly noted, and the following cases will serve to show what a big difference may be seen under various conditions:

During the summer of 1910 a large stock-raiser in central Nebraska bought a number of hogs at a public sale some few miles distant over in another county. There had been no cholera for a long time around the neighborhood where these hogs were bought, but they had no doubt been exposed in some way without the knowledge of the owner, as they began to get sick within three days after they had been brought home and placed on the new feed lots. The symptoms which they showed were those of regular old-fashioned cholera, and when one of them was cut open after death the changes found were, without any question, those produced by cholera.

When these new hogs were brought on the place they had been at once turned into the regular feed lots with the hogs that had been raised on the farm during the summer. As soon as the owner saw that the new hogs were getting sick he at once took them out of this feed lot, and put them in a pen by themselves, quite a ways from the old herd. None of the hogs of the old herd showed any signs of being sick for about fourteen days. On the morning of the fourteenth day, when he went out to feed, the owner found that several of the spring shoats did not come up, and when they were roused out of the sheds it was easy to see that there was something wrong with them. About two days later several of the old sows were sick.

This man's experience shows many very interesting things about cholera that it will pay to stop for a few seconds and study carefully, in order that we may not have a like experience happen in our own herds.

In the first place, this man made a big mistake when he brought these strange hogs home and at once placed them in the same feed lots with his own herd. We will see many examples of cases where this is done, and it is only too often that the result is an outbreak of cholera which wipes out every animal on the place. Whenever you bring any new hogs on the farm, first place them in a pen or feed lot a long ways off from your other hogs, and keep them thus separated for at least twenty-one or, preferably, thirty days. If you do this you will have a chance to make sure that they are not likely to develop cholera or any other disease which the other hogs with which you place them might catch from them.

If they have been exposed to cholera before you bought them, the disease will make its appearance before the end of thirty days. If this farmer had only done this he would not have had cholera in his old herd at all. The animals which he bought would have been the only ones he would have lost. While this in itself would have been a big loss, it would have been a small one compared with what he actually did lose when he lost not only the newly purchased animals, but nearly all of his old herd as well.

Make it an invariable rule to keep new hogs in separate pens for at least three weeks, and it is better to keep them away from your regular herd for four weeks.

Removal of Sick from Herd.—It has often been said that by removal of the sick hogs from a herd and keeping them separate we will be able to check the spread of cholera in the herd. While this is a good practice, and may occasionally be a success, it is by no means always so. As a rule, the entire herd has already been infected from the manure and other discharges of the sick animals, and it is only a question of a few days when they will come down with the disease. As a matter of fact, the urine and manure of a cholera hog are capable of causing the disease in a healthy hog for several hours before he shows signs of being sick.

Separation Into Small Herds.—About the only way in which separation of well from sick animals can do much good is to remove the entire herd to a new range or pasture, and then divide them up into small bunches of, say, 3 or 4 animals. In this way we may be fortunate enough to in part check the disease. A few of the small bunches may entirely escape and be saved, whereas, if they had all been left together, they would have taken the disease along with the rest of the herd. Once in a while, by leaving the sick hogs in the old feed lot and turning all the well animals into a new pasture which has not had hogs on it for several months, the disease may be checked. As a rule, however, it is very hard to head the disease off once it makes its appearance, except by the use of the new treatment by means of serum.

This case also gives us another very interesting point about the incubation period of cholera. It will be noted that the cholera showed up first in the shoats, and a few days later the old sows began to get sick. This is usually always the case, as the younger

the animal may be, the easier it is for him to take cholera. In other words, the young animals are more susceptible, that is, they have less power to resist the virus of cholera, and so they get sick quicker than the old sows do, because these older animals seem to have more resistance. It is very much the same in human beings with many diseases. For instance, diphtheria will very quickly attack a child, while a grown-up person may be able to fight off the disease entirely; in fact, it is seldom that men or women get diphtheria after they are twenty years old.

How Resistance Can Be Increased.—Old sows are especially resistant to cholera germs, and, as was the case in this herd, many of them pass through an outbreak of cholera without even showing any signs of being sick at all. I have seen cases where every shoat and pig on the place died, but the old sows came through in pretty good shape. This is not always true, of course, and very often the disease is so severe that it wipes out old hogs and shoats alike, and leaves the pens entirely bare. This resisting power against cholera can be very much built up by the use of serum, and especially the serum-simultaneous treatment. By proper use of this means of increasing resistance to cholera we hope some day to be able to wipe out the disease entirely, by getting the resistance of all the hogs in the cholera belt so strongly developed that the germs will not be able to make them sick.

At the United States Government serum plant in Ames, Iowa, the young shoats used for the production of virus with which to inject the hogs from which serum is obtained receive a deep injection of pure hog-cholera blood deep into the muscles or meat on the inner side of the hams. In this way the pigs receive a sure infection with cholera, and they begin to get sick, as a rule, about the afternoon of the fourth day or some time during the fifth day after they have been injected. When these pigs are killed on the fifth or sixth day they are bled so as to get the virus to inject other animals and produce serum. They are then cut open and examined, and in practically every case they show signs of cholera both in the organs of the abdominal cavity and in the chest.

In this work at the Ames plant there are several reasons why the disease should make its appearance so regularly on about the fifth day. In the first place the pigs used for this virus production

are young shoats which weigh from 50 to 100 pounds, and so are just the right age and size to very quickly take the disease.

Second, the amount of virus which enters the body of each pig is quite large, and is much more than the animal would get into its body under ordinary conditions in regular feed lots, even if cholera were present in the herd, unless they were fed with the dead bodies of animals which had died from cholera.

This dose of virus does not seem to make as much of a difference, however, as one might think. It has been found at the Ames serum plant that an average dose of cholera virus will make the animal sick just about as quick as will a much larger dose.

The rapid appearance of cholera in these pigs at Ames is also partly accounted for by the method used for getting the virus into the body. Instead of feeding the germs to the animals with the food, a syringe and long needle are used, and the pure hog-cholera blood, containing millions of hog-cholera germs, is injected deep in the muscles of the ham. In this way every one of the germs is absorbed into the system, and they have a chance to work much more rapidly than they would were they just given to the animals with the food.

Another example of how quick hogs may be taken sick with cholera when they get a large enough amount of the virus is shown by the following case: A certain farmer in southern Minnesota had left the farm, and with his wife moved to town. The oldest son remained on the home place and ran the farm on a grain-rent basis. At the home in the city the farmer had quite a large amount of empty space, and so he fenced off a small pen in which he placed two young barrow hogs. These two animals were fed with the slop from the kitchen, and also with slop and refuse from the kitchens of two or three of the neighbors, it being more convenient to give it to the hogs than to hire a man to haul it away. It was the intention to fatten these two barrows, and later on kill them for winter meat supply.

Along with other refuse which they received from the kitchens was a considerable amount of pork trimmings, such as bacon rinds, bones from pork chops, and other scraps of meat such as ordinarily come from kitchens. Late in the summer one of the animals got sick and in a few hours was dead.

As it was very unhandy to bury the animal in the city, the son sent a hired man in from the farm, and the dead carcass was loaded on the wagon and hauled out to the farm, where it was dumped over into the feed lot and left for the other hogs to eat, which they very quickly did. The remaining barrow in the city also died in a few days, and this dead hog was also taken out and fed to the hogs at the farm.

A neighbor just across the alley in the city had one hog which he had been fattening. This animal was noticed one morning to be slightly droopy He at once called up a local butcher, and the hog was killed that afternoon. It would be hard to say if this hog was getting sick with cholera or not, as it was killed before the symptoms had a good chance to fully develop, and, as there was no meat inspection in this town, it is not possible to say whether the bowels, liver, kidneys, or lungs showed cholera marks or not.

Six days after the first dead barrow had been hauled out to the farm and fed to the well animals in the herd there, 3 of the young shoats in the lot were noted to be sick, and on the next morning the disease was seen to be starting in an old boar who had been suffering with a diarrhea all summer, due to some sort of chronic inflammation of the bowels. Ten days later a number of old sows in the feed lot were developing the same signs of disease, and from this time on the death of 3 or 4 animals was a daily occurrence. Before the disease had run its course in this herd over 80 per cent. of the hogs on the place had died.

It was a most costly experience, indeed, for this man, and we will now go over it carefully, and try and pick out the important lessons that can be derived from it.

To begin with, the plan of raising hogs on kitchen slop and table refuse is a very poor practice. While table refuse and kitchen slop when fresh, as it was in this case, is not so very dangerous, it is not by any means a suitable food for any form of animal. We cannot expect even a hog to do well when he is forced to eat such food. When, as is usually the case, the slop is allowed to stand for hours or even days in filthy slop barrels, and decompose and rot before being fed to the animals, it becomes absolutely a disease-breeding food, and no hogs can be kept on this

kind of food for any length of time and remain free from disease. If cholera does not make its way into the herd some other disease will.

When to the ordinary leavings of the table and kitchen, such as bread crusts, sour milk, potato peelings, rotten apples, etc., we have added scraps of pork, such as bacon rinds, ham trimmings and bones, and rib bones or other scraps of pork, we are certainly adding something which is most dangerous, and is very likely to result in an outbreak of cholera in the hogs which are so fed. As we shall find out a little later on, when we closely study cholera, the germs or virus of the disease are to be found in the blood. By the blood the virus is carried to all parts of the body and deposited in every tissue. The very small blood-vessels in the skin are filled with this virus-carrying blood, and the same is true of the small vessels located in the little hollow spaces of bone.

From the results which have followed the feeding of pork trimmings to healthy animals it cannot be doubted that when from fresh pork, such as is commonly sold in the retail markets of our cities, these trimmings may contain a sufficient amount of the virus to produce disease. It has also been found that the germs of cholera are so hard to kill that they are not always destroyed by the ordinary curing processes which are used in preparing pork for the market. As a result, when these trimmings are fed to healthy animals they are made sick, and by this means cholera may be spread over large sections of the country.

Another very costly lesson which this man learned from this outbreak, and which we should take advantage of, is the fact that we cannot feed carcasses of dead hogs to our healthy animals and expect them to keep well. This is, of course, the more true if the hog which has died was suffering from cholera, as is only too often the case. This feeding of dead cholera hogs was the direct cause of the outbreak on this farm. It cost this man nearly one thousand dollars to learn the lesson. You now have the opportunity of profiting from this man's experience at practically no cost whatever. The object of telling about so many of these everyday cases throughout this work is in order that the reader may the more plainly see what have been the experiences of others. Experience is the best of all teachers, and everyone

should be always on the lookout to profit from the experience of others, as well as to be ready to allow others to profit by his experience.

This man found, just as hundreds of others have found, that whenever hogs are allowed to feed upon the dead bodies of animals which die upon the farm, it will only be a matter of time until there will be an outbreak of cholera among these hogs. Meat of hogs which have died of hog-cholera is simply full of the virus which produces the disease, and it is at this time in its most virulent form, capable of producing the disease very rapidly in any animal which may eat of it. If healthy hogs are allowed to eat these dead bodies of cholera hogs they will get sick just as surely as if the germs had been injected into their muscles with a syringe and needle, as is done at the government serum plant.

Another interesting point about this outbreak is the ease with which the boar was attacked by the disease. Under ordinary circumstances an old boar has quite a bit of resistance to the germs of cholera, and very often will remain well while every other hog on the place may get sick and die from the disease. This boar had been weakened by a long-neglected inflammation of the bowels, and was in no condition to put up any fight against the cholera virus when it was taken into his body. As a result, he was an easy victim. Give close attention to your hogs, and do not let any diseases of their stomach or bowels be neglected. To do so is to open the door for the entrance of cholera into the herd, and cholera is always on the lookout for the open door. . It will not have to be left open very long until you will begin to see hogs sick with the dread disease.

Never keep an unthrifty or sick hog on the premises. If the disease from which the animal may be suffering does not respond to ordinary treatment, the best thing that you can do is to either sell the animal for immediate slaughter or else knock him on the head. An unhealthy hog is always a source of danger. Cholera is likely to finish up such a hog at any time, and before he has died he has been the means of scattering infectious, disease-producing virus among the entire herd. It is far cheaper to kill this one animal, or sell him at a loss, than to run the chances of having an entire herd wiped out by hog-cholera.

Average Incubation Period.—From the above case histories it can be seen that the length of time between exposure of healthy animals to cholera and the appearance of signs of sickness is not by any means always the same. We have found that symptoms of illness may show up in three days, or they may not get sick for nearly thirty days. As a general rule in actual practice, it is found that this period of incubation will be from ten to fifteen days. In other words, it is usually ten to fifteen days after the animals are exposed to cholera before they commence to get sick. This may then be stated as the average incubation period of cholera—ten to fifteen days. It may be shorter, even as short as three days, or it may be prolonged to four weeks.

In serum-manufacturing plants, where the virus is injected direct into the muscles of the hog, it is usually found that they get sick during the first week.

SUMMARY

Incubation periods vary from three to thirty days.

Average incubation period is ten to fifteen days.

Among those things which have a tendency to make the incubation period shorter or longer are the following:

(1) *Condition the Hogs are In.*—If hogs are run down they get sick quicker.

(2) *Age of the Hogs.*—Young shoats show sickness quicker than do old animals.

(3) *Amount of Virus.*—The greater amount of virus that is taken into the body, the sooner the animal will get sick.

(4) *Strength of Virus.*—Sometimes the virus is more powerful than at others. In case the virus is real powerful (highly virulent) it will, of course, produce disease quicker.

(5) *Period of Outbreak.*—Animals usually get sick quicker at the beginning of an outbreak than later on, when the strength of the virus seems to sort of run out.

(6) *Temperature.*—In very hot summer weather and in very cold winter weather the animals get sick very soon after being exposed.

TYPES OF CHOLERA AND THEIR SYMPTOMS

Every outbreak of cholera is not alike, and the symptoms of the disease are by no means always the same. Some epidemics are very severe, others mildly so, while some outbreaks are very mild in their course. Accordingly, in taking up the symptoms of cholera it is advisable to divide it into about three classes or types of cases, as follows:

(1) *The Very Severe Type.*—This is also spoken of as the fulminant type.

(2) *The Acute or Rapid Type.*—This is what is commonly known among stock-men and farmers as "the old-fashioned cholera."

(3) *The Chronic or Slow Type.*—In this form of the disease the animals are never decidedly sick, but just keep running down and down until they become stunted and runty, and either die or remain stunted as long as they live.

SYMPTOMS OF VERY SEVERE TYPE

In the first few herds of hogs that are taken sick at the commencement of an outbreak of cholera early in the season there are often seen some cases in which the animals die without even having been noticed as sick at all. In the morning the owner goes out to the pens, and finds that during the night one, two, or maybe a half-dozen hogs have died. The next morning the same thing may be found again.

Very often when these hogs are cut open after death, even by expert veterinarians, it is almost impossible to find any changes in any of the internal organs which will help very much in making up our mind as to the cause of death. It has been, indeed, well stated by Dr. Connaway, of the Missouri State Agricultural College, that in these cases the hog is simply dead, and we are unable to see any reason as to why he died, but the fact remains that he is dead. Very often we may examine several animals that have died in a herd before we find one in which there is sufficiently clear evidence on which to make a positive diagnosis as to the cause of death. Cholera should, however, always be suspected in these cases, and every effort made to prevent further spread of the dis-

ease, just the same as if we had absolute proof that the disease was cholera.

In most of these cases we will soon have proof enough that the outbreak is cholera. Other herds in the vicinity will become affected, and it is not long until we will be able to find dead hogs in which the changes in the kidneys, bowels, liver, spleen, and lungs show typical signs that the disease is indeed cholera.

Other cases which are also classed in the very severe or fulminant type show a period of severe illness for twenty-four to thirty-six hours before they die. During this time the sick animal is very stupid and dull, becomes very weak, and loses strength very rapidly. The sick hog absolutely refuses food of any kind, but will often show a most marked thirst, and a high temperature, which will frequently run up as high as 110° F. or over. The animal when he tries to walk is very unsteady and tends to weave and stagger, especially in the hind limbs. Finally, the hog gets clear down and remains down, being unable to rise even when efforts are made to force him to do so.

In such cases death frequently takes place during the night or on the day following the attack, and in these animals when we make a postmortem examination and open the dead body, we find the engorged and swollen spleen, enlarged liver, spotted kidneys, and reddened bowels which are diagnostic of cholera. In these cases the red spots on the internal organs, especially the kidneys, bladder, and lungs, are common, but the ulcers in the bowels which are found in other forms of cholera are usually absent. This is due to the fact that the disease runs such a short course there is no time for ulcers to form. It takes several days for ulcers to form in the bowels, and death in these very acute cases takes place before the hog is sick more than twenty-four to forty-eight hours.

SYMPTOMS IN ACUTE TYPE

Acute cholera does not make as rapid a start as we have just seen in the very severe or fulminant type of the disease, but commences more slowly and in a sneaking sort of manner. Like the thief in the night, it creeps up slowly, and is firmly started in the herd before the owner is fully aware that there is anything the

matter with his hogs. This is especially likely to be the case where there is no cholera known to be in the vicinity.

About the first thing that the owner notices wrong with his hogs, if he is a man that keeps a careful eye on them, is a dropping off from feed. One or two shoats will be noted in the morning or at evening that do not seem to care for food, and prefer apparantly to remain buried in the litter or to lie over in a distant corner of the feed lot. At the same time, the animals seem to lose a great deal of their normal liveliness and activity. A healthy young shoat is always full of life and ginger, and when one loses this natural playfulness there is nearly always something wrong. Healthy shoats will always be found ready and willing to eat at feeding time, and they will always fight for their share of the feed. When they begin to get sick from cholera they lose this fighting spirit and are not at all interested in whether they get their share of the food or not.

Nearly everyone has noted the fact that a healthy hog has a neat kink or curl in his tail. When a hog begins to get sick with cholera or, in fact, from any other severe sickness, this kink in the tail disappears and the tail becomes straight, drooping, and almost lifeless.

As the symptoms of the disease become a little more advanced and well marked, the animal shows more distinct signs of being ill. The sick hog seems to desire to be left alone and allowed to keep quiet. He will burrow himself in the litter and remains lying down most of the time. If noted carefully it will be found that the sick shoat prefers to lie upon his belly rather than upon either side. As the animals become more and more sick they refuse to respond to the feed call of the owner and remain all the time in their litter, showing only a desire to remain quiet and not be disturbed. If water is brought to them they will usually drink eagerly, but they do not touch food, such as corn, which may be left right under their nose.

If aroused, the animal shows plainly by painful grunts and squeals that it does not want to be disturbed. When the body is touched with the hand it is found to be very hot and often almost burning. At the same time the hog appears very tender and the skin is very sensitive.

When the sick hog tries to get up it is hardly able to do so, and especially has trouble in getting up on its hind legs. The hind parts of the body are especially weak, and even after the animal gets into the standing position the hind limbs are so weak that it is often hardly able to stand. One hind foot is usually crossed over the other, and when the animal starts to walk it is easily noticeable how weak the hind legs are from the staggering gait and weaving of the hind parts.

When the patient is looked at real closely it will usually be noticed that there is slight trembling of the muscles, and even a light chill may often be seen. If the temperature is taken by a thermometer placed in the rectum it will be found practically always that the hog has considerable fever, often the temperature running as high as 106° F., even this early in the disease.

Every day the symptoms of the disease become a little more severe, and especially is it noted that the weakness of the muscles of the hind limbs becomes more marked. The animal has greater difficulty in getting up every time it lies down, and when it is forced to stand or walk it is scarcely able to keep on its feet, so pronounced is the weakness of the muscles. There is more and more marked difficulty in trying to walk, and the staggering becomes more and more noticeable. This weakness of the muscles keeps getting worse and worse as the disease progresses, until finally it gets so bad that the animal is unable to either get up or remain standing after he does get up.

The sensitiveness of the skin, especially the skin over the flanks and belly, becomes more severe each day, and the touch causes discomfort and pain, which the hog shows by painful grunts. He is too weak to make any show of resistance, but simply lets you know that it hurts him by plaintive grunts.

The appetite, which is practically lost from the start, is lost entirely when the disease gets well advanced, and the animal absolutely refuses food of all kinds. There is, however, a burning thirst, as a result of the high fever, and if the sick hog is in a pasture where there is a running stream, this desire for water, both internally and externally, will usually cause him to travel to the banks of the stream, where he will burrow himself in the cooling water and mud to relieve the discomfort produced by the high fever, which is

simply burning up the body of the animal and drying all the water out of his tissues.

When cholera animals have the range of a pasture in which there is a running stream the dead hogs are usually to be found either in the stream or close by its banks.

In a very large number of cholera cases the sick animal, if aroused and forced to get out of the litter and move about, will take a few staggering steps, then stand with the back arched, the flanks drawn up, the hind legs crossed, the tail drooping, the head low, and start to cough. This cough of cholera is more or less

Fig. 51.—Typical case of hog-cholera. Note droop of tail, arching of back, and cough.

peculiar. It has something about it that is different from any other cough which hogs have, and once it has been heard it is not hard to tell when you hear it again. It is a sort of dry, suppressed, barking cough, but has to be heard to be fully appreciated. Many experienced veterinary surgeons and livestock men can tell it the minute they hear it, and can made a pretty good guess on the diagnosis of the case without even seeing the sick hogs at all.

This cough, however, is not present in all cases. It is more common and more severe in those cases where there is severe cholera infection of the lungs and other organs in the chest. I have, however, seen many sick hogs which had a very severe cough dur-

ing the course of the disease, and yet which showed but very little disease in the lungs when opened up after they had died. In these cases, however, there was no doubt a sufficient amount of the virus in the blood circulating through the lungs to cause severe irritation, and bronchitis enough to produce a bad cough without showing any marked change in the lungs on examination after death.

As the course of the disease progresses there is the appearance, about the second or third day, of a very important and decidedly common symptom, one which is of great help in making a diagnosis of the disease. This is the appearance on the skin of a number of bright red blotches or spots. These first make their appearance on the ears, the eyelids, the snout, the breast, the inner side of the flanks, in the fold between the front legs and the chest-wall, and along the belly.

These spots first appear simply as a red flush of the skin, and disappear if they are pressed upon by the finger, but return again in a few seconds after the finger is removed. As the condition gets worse the ears begin to swell, and a little later there is swelling of the eyelids and other parts of the skin. There is now noted the appearance of another kind of reddish spots in the skin. The spots which now appear are of a darker red color, being often a deep purple or bluish shade rather than a bright red, as were the first spots noted. These new spots are also more permanent and will not disappear on pressure with the fingers as did the ones first described. Some of them are very small, being about the size of a pin-point, while others are quite large, and some of them may be even as large as the palm of the hand.

In some of the very severe cases the skin is spotted over with these red spots from one end of the body to the other, and it is not unusual to find an animal in which the entire skin appears bright red in color. This is due to the fact that the hog-cholera virus after it enters the body is carried into the blood-vessels, and it causes these vessels to get swollen and filled with bright red blood. This is what causes the redness. When we press on these swollen blood-vessels with the finger we force the blood out of them, and that is why the redness disappears on pressure. In more severe cases the virus collects in the small blood-vessels and plugs them up, or

they become so swollen that they burst. It is then that we get the purple or bluish-colored spots, which are permanent and will not disappear on pressure, because the blood is no longer inside the blood-vessels.

As has already been mentioned, swelling of the eyelids and snout is quite common in cholera. In some cases this redness and swelling of the eyelids becomes a very marked symptom, and we have, in addition to the swelling, an inflammation of the inner surface of the eyelid, and with this there is a thick yellowish discharge from the eye. This sticky, matter-like substance causes the eyelids to glue together, and this, with the swelling of the eyelids, makes it impossible for the hog to see. When we consider, in addition to this, that the animal is very weak, and especially so in the muscles of the hind limbs, we are very easily able to understand why it is that the sick hog staggers so when he tries to walk, and often this staggering is accompanied by such a marked degree of blindness that it may very properly be regarded as blind staggers.

In connection with the swelling of the ears there is often seen formation of small blisters both on the inside and the outside of the ear. When these form the ear is usually very much swollen and may be two or three times its natural thickness. These blisters very often break and we have left in their place a small sore or ulcer. This scabs over, and we may see cases where these scabs run together so as to form one large sore which covers the entire surface of the ear, either on the outer aspect or on the inner surface. It is not the usual thing to find this marked soreness of the ears, but in a very large number of cases we find the ears are very much swollen, thickened, and red in color.

The swelling and redness of the snout is also commonly found to be quite extensive, and in addition to the redness here we may also have the formation of small blisters and even sores and scabbing, as in the case of the ears. The very first places for redness and swelling to appear in most cases of hog-cholera are the ears and snout. They should always be looked for in these locations, and then on the under surface of the belly, the inner side of the loins, the flanks, and on the fold of skin between the foreleg and the wall of the chest.

With the steady progress of the disease the appearance of the

sick animal becomes more and more typical and the case easier to diagnose. There is a rapid loss of flesh, and the hog becomes very thin, gaunted, and weak. The weakness is especially to be seen when you try to arouse the animal. He is so weak that it is almost impossible for him to rise, and when he does get on his feet he is hardly able to stand. The position in which a cholera animal stands is a very familiar one to those who have seen many cases of the disease.

The hog sick with cholera stands with his head down, the ears drooped, and the eyes closed, due to both the swelling of the eyelids and the sticking together of the lids from the sticky discharge that results from the inflammation of the lids. The back is arched up and the hind legs drawn further forward than they are held in the healthy animal. The flanks are drawn up and give the animal a very gaunted appearance. The hind legs are not only placed further forward under the belly than in the case of a healthy hog, but the animal also very frequently stands with the hind feet crossed, and one foot may be resting upon the other. The tail is drooped and hangs practically lifeless. The skin of the animal has a very dirty and somewhat greasy appearance, due to the fact that in the course of cholera there is a marked increase in the amount of oily secretion given off from the glands of the skin.

When the animal tries to walk we note again some very typical signs of cholera. Due to the great amount of muscle weakness, it is very difficult for the animal to get along, and, as this weakness is most marked in the hind limbs, there is especially a tendency for the body to swing from side to side in the hind parts. The hind limbs are used with a great deal of effort, and when the hind feet are moved it is common for the animal to get one leg crossed over in front of the other, much as does a drunken man when trying to walk in a straight line. Difficulty in walking is made more pronounced by the fact that the animal is practically blind. There is nothing wrong with the sight of the eyes, as far as the seeing apparatus goes, but the lids are so swollen and tightly glued together that it is impossible for the animal to keep the eyes open. On this account the staggering gait of the hog becomes very much worse and we have a walk very much like that seen in blind staggers.

Stomach and Bowel Symptoms.—Hog-cholera of the acute and chronic types has a very marked effect upon the condition of the stomach and bowels. In opening up the animal after death we find that there are very marked signs of the disease to be found in both the stomach and large and small bowels. It is not surprising, then, that we should have very noticeable disturbances in the action of these organs.

This disturbance of the stomach is first noticed as a loss of the appetite. This is, by the way, one of the first of the important signs of cholera. The animal loses all desire for food, and cannot be tempted by even the most favorite foods. Not only will the sick hog refuse to come to the trough for food, but, even if food is carried to him and placed in front of his nose, he refuses it. In a few cases there is loss of appetite for the usual articles of food, such as corn, slop, mashes, and bran, but the animal will eat strange articles, such as dirt and old rotten wood. In other cases the stomach trouble becomes very acute and severe. In these cases the hog not only loses the appetite, but he may also get very sick at the stomach and vomit quite freely and often. In those animals where vomiting occurs it is very often found after death, when the body is opened up, that the inner surface of the stomach wall is the seat of a number of dark-colored sores or ulcers. In addition to these ulcers there is also usually found a very bright red congestion or inflammation of the stomach.

While appetite is lost early and quite completely in cholera, thirst is usually increased. This is, in large part, due to the very high fever from which the sick animal suffers throughout the course of cholera. This burning fever rapidly uses up all the fluids in the animal body, and it is necessary that the hog take in large quantities of water to make up for that used up by the fever process. As evidence of this great thirst, the sick hog usually seeks a wallowing place, or makes its way to a running stream, if there be one in the pasture. In the cooling waters of the stream the animal will burrow itself, and thus get the benefit of the cooling influence of the water, both externally and internally.

At the start of the sickness, with the rise in the fever and the loss of appetite, there is usually a short period of one or two days in which the condition of the bowels is that of constipation. The

burning fever dries up the contents of the bowels, and the animal is unable to empty them for some time. This condition of constipation may remain through the entire course of the disease. In many cases the animals die with the bowels packed full of feces.

There are a large number of cases, however, in which, after a few days, the condition of constipation changes to just the opposite condition, and we have the starting up of a very free and weakening diarrhea. This diarrhea is of a very peculiar kind, and, when present, is a big help in making a diagnosis of the disease. It may start as a rather brownish, semisolid stool, but a little later on the discharge that comes from the bowels becomes very black in color, has a most disagreeable stinking odor, and is almost as thin as water. This is the typical hog-cholera diarrhea—black in color, thin and liquid-like, and with a very disagreeable odor.

In some cases, where the animals are running on a green pasture range, the diarrhea may be of a greenish color instead of black. There are some other foods that may somewhat change the appearance of this discharge, but the one usually seen, and which always leads one to think of cholera, is the black, watery diarrhea. In some cases there may be one or two days of constipation, followed by one or two days of scouring, and then another period of constipation. This may keep up throughout the course of the disease, the animal been bound up one day and scouring the next. As a rule, when the scouring once starts it is kept up until the animal dies.

As a result of this scouring we have a marked increase in the weakness of the hog. This constant diarrhea is very exhausting, and, when kept up every few minutes for a couple of days, the poor animal is hardly able to stand from the weakness which comes on as a result of the constant drain upon the system resulting from this profuse discharge. When we take into consideration also the effects of the poisons produced in the body by the virus itself, and the action which they have upon the muscle cells, it is no wonder that the animal is scarcely able to stand or walk.

As a result of the large amount of liquid discharge resulting from the continued diarrhea the tail and hams of the sick animal become badly soiled with the black-colored liquid, and have a very disagreeable appearance and a most stinking odor. With the loss

in strength there is also a rapid increase in loss in weight, and the animal quickly becomes very gaunt and drawn up. The weakness finally becomes so marked that the animal is absolutely unable to rise or stand, even if placed upon his feet, and finally death relieves him from his suffering, usually taking place during the night.

Breathing and Pulse.—Early in the disease there is not very much interference with the breathing, but later on, especially in those cases where the lungs are very much affected, the breathing becomes very rapid and short. In some cases the tissues around the throat become quite swollen, and this swelling, by pressure upon the wind-pipe, increases the difficulty of breathing. In such cases the breathing becomes very noisy as well as rapid.

When the virus of hog-cholera begins to multiply in the body of the animal, the poisons produced are taken into the blood and carried to the heart. The effects of these toxins or poisons are to irritate the heart and make it beat more rapidly. This causes the pulse to become more rapid, and at the same time it is more full and bounding, due to the increased force of the heart-beat.

Later on in the disease the amount of the poisonous material in the blood becomes so great that it simply poisons the heart, until that organ is no longer able to stand up under the strain. As a result, it begins to beat more rapidly than ever, but at the same time gets very feeble and weak in character and soon wears itself out. In the last few hours of the disease the heart-beat becomes exceedingly rapid and weak, and often the pulse can scarcely be felt at all. Death probably is the result of actual wearing out and failure of the heart muscle, due to the poisonous effects of the toxins produced by the hog-cholera virus.

Thumping.—In a severe case of cholera, when the respiration or breathing becomes very rapid, it is not unusual for the sick animal to develop a case of thumps. This thumping is due to a spasm of the midriff or diaphragm, which is the large fan-shaped muscle which separates the organs of the chest from those of the belly. This muscle has a very important part to do with breathing, and when the breathing becomes too rapid, as in hog-cholera, it goes into a spasm, and we then have the familiar condition known as thumps, in which at each respiration there is a spasmodic drawing in of the hind ribs. Thumps is much more likely to occur in pigs

and young shoats than in old hogs, but it may even be seen in these old animals in some of the severe cases.

Those cases in which thumping develops are of a most severe form, and the outcome is usually fatal. This is especially so in young pigs affected with cholera. When thumps starts in these little fellows they are almost certain to die.

Changes in Urine.—The action of the kidneys is not interfered with in cholera nearly to the extent that we might expect, when we see the amount of actual change that takes place in the structure of the kidney as a result of the disease. The amount of water passed is, however, less than usual; it is more highly colored than normal, and may even show the presence in it of a considerable amount of blood. The specific gravity or weight of the urine is much increased, and when the water is sent to a laboratory and examined under the microscope it is found to contain a considerable amount of blood, lining cells from the inside of the kidney, and casts made up of clotted blood.

In well-developed cases of acute cholera when an attempt is made to examine the animal there will be found marked tenderness and hypersensitiveness of the skin. This is especially well marked along the belly. Back in the fold of the flanks there can often be found a quite large, soft swelling, which is very tender when touched with the fingers. This is the swollen lymph-glands, which are normally located in this position, and which are known as the inguinal lymph-glands. In a healthy animal these glands are small kernel-like bodies, which can scarcely be felt through the skin and muscles. In hog-cholera they swell up until easily felt, and become very sensitive and painful.

Summary.—In making a diagnosis of acute cholera we should base our opinion upon the following important symptoms:

(1) Rather slow onset, with loss of appetite and tendency to remain buried in the litter of the sleeping pens as one of the very first noticeable symptoms.

(2) The sick animal loses its natural activeness and playfulness. Prefers to remain undisturbed and will hide off by itself in some corner or under the litter.

(3) Normal curl or kink in the tail disappears and that organ hangs lifeless and straight.

(4) While appetite is lost, there is a marked thirst, which becomes greater as the disease progresses.

(5) Temperature goes up very rapidly, and the animal has several degrees of fever within a short time after the disease starts. Temperature may run up to 106° or 108° F. and even higher.

(6) Skin is dry and hot at first. Later on it becomes covered with a sticky, black-colored, grease-like fluid which is poured out by the glands of the skin.

(7) Scarlet-red flushing and bluish-red blotches make their appearance on the skin, especially around the ears, on the snout, chest, inner side of the forelegs, flanks, and along the under surface of the belly These red spots are more easily seen in white hogs than in the black-colored breeds.

(8) Ears, in addition to being red, are swollen and often covered with blisters and small sores. These sores are especially likely to form in hot weather, when the blisters become poisoned from the bites of flies.

(9) Sick animals are at first constipated. Later begin to scour freely, and develop a very stinking, profuse, black diarrhea. This diarrheal discharge soils the skin of the hams and around the tail.

(10) When aroused from the litter of the sleeping pens and forced to move about, the sick animal starts to cough. This cough is of a peculiar dry, forced, hacking nature.

(11) Animal stands with the back arched and the flanks drawn up in a gaunted position.

(12) Sick animals lose weight very rapidly, and this increases the gaunted or runty appearance of the sick hog.

(13) Animals develop very marked weakness in the muscles, especially the muscles of the hind legs. This weakness makes it very hard for them to get up or to walk.

(14) Hogs sick with cholera have a peculiar staggering walk. They especially stagger with the hind legs. In some cases the weakness of the muscles and the swelling of the eyes combined produce a condition very much like blind staggers.

(15) Eyelids are swollen, and there is redness of the inner side of the eyelid, with a thick, yellow-colored, matter-like discharge. This often glues the eyelids together and adds to the blindness and staggering gait when the animal tries to walk.

(16) Animal stands in a peculiar manner. The back is arched, the flanks drawn up, and the hind legs are crossed over each other. When the animal tries to walk there is a tendency to throw one hind foot in front of and across the other.

(17) Skin becomes very sensitive to the touch. Animals grunt with pain when touched, even if but very lightly.

(18) The small lymph-glands, which are located just beneath the skin in the fold of the groin, become swollen, softened, and tender.

(19) Breathing more rapid than normal. Often becomes difficult and noisy in character.

(20) Pulse at first is rapid and strong. Late in the disease pulse becomes rapid and very feeble.

(21) Urine becomes very much less in amount than normal. The color of the urine is darker than it should be, and it may even be colored with blood.

(22) Thumping often becomes a symptom in young pigs and shoats. This may even develop in old hogs, but not nearly so often as in young pigs.

(23) Death is the outcome in a very large percentage of the cases.

(24) Duration of the disease in the acute form of cholera is from a few days to two weeks.

(25) Some cases pass from the acute form into the slow or chronic type. These cases are long drawn out, and may end in recovery in a few cases. Usually those which recover are left in a runty condition.

Percentage of Deaths.—In considering the chances for recovery of an animal which has been attacked by cholera the outlook is anything but favorable. Farmers everywhere have come to the conclusion that cholera in a herd is pretty near certain to wipe it out. In most outbreaks in the Central and Western States the disease is very severe, and the number of hogs which live through an epidemic is very small.

Not only is the disease pretty certain to produce death in every animal attacked, but it is also likely to attack almost every hog on the premises. It is only occasionally that we find one or two hogs on a place that are not sick when the disease once gets on the

farm. Cholera, once it gets into a herd, will usually attack every hog on the place, and by far the larger percentage of them will die.

It is a pretty safe estimate to say that at least 8 out of every 10 will die unless serum be used early. Of those that are left after an attack of the disease there are a great many that are practically useless. They are hopelessly stunted, and if allowed to live they simply grow up as runts, never being worth the grain that it takes to feed them. It is a better policy to knock these runts in the head, as they are not only of no value, but they may also be a source of spreading the disease among healthy hogs.

These runty hogs left after an outbreak of cholera seem to still have, somewhere in their body, a local infection with hog-cholera virus, and they are often discharging with their urine and manure enough hog-cholera germs to start up the disease in a healthy herd.

I know of an instance of this kind where a farmer purchased a half-dozen hogs from a neighbor at a public sale. In the herd was one stunted shoat which had been through the cholera the previous summer. When these hogs were taken home they were placed in the pasture with the home herd. Two weeks later cholera broke out on this farm and wiped out nearly the entire drove.

In this case there was no other cholera in the neighborhood, and it seems almost a certainty that this runty pig was the means of infecting all the other animals.

CHRONIC CHOLERA

In some outbreaks of cholera nearly all of the cases seen are of the chronic type. In other outbreaks the disease starts in as the acute type, and, after the animals have for a few days shown signs of the acute form, they may pass into a more mild and long-drawn-out form—the chronic cholera type.

In those outbreaks where the form of the disease is of a chronic nature from the beginning, the animals develop signs of illness very slowly, and may be coming down with the disease for several days or even weeks before the owner notices that there is anything wrong with them. As a matter of fact, in some cases the attack is so mild in its symptoms that the animal may pass through the entire course of the disease and never be noticed as actually sick. Perhaps the

sick animal may be noted to be just a little off feed at times, but the next day may be eating again as usual. This hidden nature of the symptoms may lead to a great deal of damage. Hogs suffering from these very mild cases of cholera are often bought as apparently healthy animals and added to a new herd, with most sorry results.

It seems in these cases that an infection which is not capable of producing acute symptoms in one herd of animals may, when carried to a distance and introduced into a new herd, have the effect of setting up an outbreak of the most severe nature, with all the symptoms of acute cholera.

I know of several cases where this very thing has happened. Hogs were purchased which were, to all appearances, in good health. They were taken to new surroundings and placed in the feed lots with other hogs, and one to two weeks later the usual symptoms of cholera began to show up in these new herds. When passed on to the new herd the disease made a most wonderful change, and, instead of being masked by a few doubtful symptoms, showed all the evidence of the real old-fashioned hog-cholera.

An animal which is suffering from the chronic form of hog-cholera is usually carrying a number of large ulcers in the bowel, and is passing with the manure large amounts of the virus which produces the disease. This virus will attack any healthy hog with which it may come in contact, and when it is introduced into a new herd the type of disease which it produces is often much more severe than that which was present in the animal that spread the infection.

Carelessness with respect to closely noting the condition of animals that are being added to the herd, and failure to enforce a proper period of quarantine before adding them to the other animals on the place, has often led to most fearful losses. The introduction into the herd of a single animal suffering from chronic cholera has often been sufficient to start up an outbreak which will wipe out the entire herd before it can be checked. It is impossible to be too cautious in this respect, and no new animals should be added to a healthy herd unless they are first placed in a separate pen and carefully watched for a period of at least three weeks, and preferably for four weeks, to see that they are absolutely free from disease. This may mean a little inconvenience

sometimes, but it will also often mean the saving of thousands of dollars, both for the man who goes to this trouble and also to his neighbors; for once an outbreak of cholera gets started in a neighborhood there is no telling when or where it is going to stop.

Symptoms of Chronic Cholera.—As has already been stated, the symptoms of chronic cholera are often very hard to notice. The disease comes on quite slowly, and there is no stormy onset with severe symptoms, such as sometimes marks the more violent outbreaks of the acute type. About the first thing that is noticed as anything wrong is some slight change in the appetite. The appetite is not entirely lost, as a rule, and yet the animal is noted not to be eating just right in some way or other. For a day or two the sick animal may appear to eat as usual, and the very next day refuse food almost entirely. Again, there are cases where the appetite appears to be lost only for certain articles of food. For instance, in some cases the animal will refuse to eat corn, but eats other articles of food with fairly good relish.

As in the acute form of the disease, there is usually an early disappearance of the natural healthy kink of the tail. This organ simply straightens out and hangs lifeless, instead of being curled up over the back as it naturally is in a healthy hog. It is a pretty good rule to follow that so long as the tail of the pig is carried over the back in a curl, and the appetite remains good, the pig is in a healthy condition. It is one of the first signs of disease when the tail loses its curl, and usually about the same time there will be found to be a change in the appetite.

With the onset of a chronic cholera outbreak, if the animals that are a little off on their feed are watched closely, it will be found that they are beginning to lose a great deal of their natural liveliness and energy. They forage about less than usual, and they do not care to partake in the liveliness and playfulness of the other young hogs in the same pasture with them. Instead of this natural vigorous activity that is seen in health, the animal has more of an inclination to wander off by itself and lie over in a corner of the lot, or go into the sleeping pens and huddle up in the bedding. In a herd that is running in a pasture or feed lot in which there is located a straw pile the sick animal will go and burrow under the

straw, and does not come out even when called at feeding time. This is nearly always a certain sign that something is going wrong, for a healthy hog will practically never fail to come when called by the owner at feeding time. If the owner is a really close observer of his hogs he will note, even before they refuse to come up at call, that for a day or two a few of the hogs are rather slow in responding to the call, and that they do not squeal for their food, or put up a vigorous fight at the troughs for their share. Any healthy hog will squeal for his food at feeding time, and will keep up a steady running fight for his share of the meal as long as there is anything in sight to be eaten.

About the next thing that can be noticed is the commencement of an irregular action on the part of the bowels. At the start for a few days this takes the form of a constipation, but a little later on the animal begins to scour. The passages from the bowels during this diarrhea are dark in color and have a very disagreeable, stinking odor. In the course of a few days the bowel discharges may be found to be streaked with blood, and in many cases there pass out small shreds of the ulcerated bowel. This is due to the fact that the disease causes a number of ulcers to form, and these may be shed off and pass out with the feces as a part of the blood-stained discharges.

For several weeks there may be kept up these periods of diarrhea and constipation. One day the hog is scouring, and the next the bowels are bound up, or there may be constipation lasting for three or four days, and then all at once the diarrhea commences again and the animal scours every few minutes, with a profuse, watery, black discharge. It is not unusual to have this alternating diarrhea and constipation keep up throughout the course of the disease in chronic cholera.

In chronic cholera the thermometer may show but very little rise in temperature. In most cases, however, there will be a little fever present. There is never seen the rapid rise to 106° or 108° F. that occurs in connection with the acute type of cholera described in preceding pages.

The red blotches on the skin, which form such an important sign of acute cholera, are not so marked in the chronic form of the disease. There may be a few red spots, especially back of the

ears and inside the forelegs, but there is seldom ever the widespread discoloration of the skin that is seen with the acute cases.

There is often some swelling of the ears and of the eyelids, but it comes on more gradually than in the acute form of cholera, and the swelling of the eyelids is seldom so marked as to cause blindness. The swelling of the ears may become quite extensive, and the flies, which are so plentiful around feed yards in summer time, attack these swollen ears, and often result in the formation of large sores which are covered over with scabs. I have seen numerous cases where the entire inner surface of the ear was covered with a solid mass of these sores, resulting from the bites of flies.

After the disease has been working on the animal for a few days the skin begins to pour out a dark-colored, sticky substance, which sticks to the hair and serves to give the animal a very dirty, unthrifty appearance.

As the disease progresses the animal loses flesh all the time and gaunts up very rapidly. The flanks are sunken in and drawn up and the back arched. This loss of flesh is not so rapid as in the acute type, but it continues for several weeks throughout the course of the disease, and results in a much more stunted appearing animal than is seen in the acute form of the disease. Late in the course of a case of chronic cholera the animal presents about as runty an appearance as can be seen in any other disease to which the hog is heir.

Accompanying this loss in weight there is also a gradual loss of strength and the development of muscular weakness. This has the same result as in acute cholera. The animal becomes unable to get about very well, and develops a wavering or staggering gait. As in acute cholera, this weakness is most pronounced behind, and in walking the animal has trouble to keep the hind legs from getting crossed over in front of each other. The weakness and staggering in the chronic form of cholera differs from that seen in the acute cases, principally in that it is much slower in making its appearance and is not well marked until the animal has been sick several days or even a couple of weeks.

When we try to make a close examination of the sick hog suffering from chronic cholera we find that there is a great amount of tenderness, especially along the under surface of the belly. This

sensitiveness is not so pronounced as that seen in acute cholera, and it is also more limited to the belly. In acute cholera the skin is sensitive all over the body and the animal grunts whenever it is touched. In the chronic types of the disease the tenderness is more limited to the surface of the belly.

If the hand is rubbed over the inner surface of the flanks and along the folds of the groin we will find that the lymph-glands located in this region are enlarged, swollen, and often quite tender.

Course of Chronic Cholera.—The length of time which the animal will remain sick with chronic cholera is usually several weeks. The course is much more long drawn out than in the acute cholera, and the final outcome of a case of chronic cholera is rather doubtful. There are quite a large number of hogs that have chronic cholera and recover. There are some of these chronic cases that are so mild and the symptoms so slight that the animal goes through the entire course of the disease, and the owner never suspects that there is anything wrong with his herd. He may notice that the animals do not clean up their feed as well as usual for several weeks, and he may note that in some way or other they do not take on flesh like they should. He is more likely to think that the animals have worms than to suspect that they are suffering from chronic cholera. These are the cases that are especially dangerous, as likely to be added to a healthy herd and infect them with cholera virus, which in its new surroundings may prove to be very highly virulent and produce most severe symptoms of the acute form of the disease.

This is a point always to be remembered, that an animal suffering from chronic cholera, and showing practically no symptoms at all of anything much out of the way, may, when added to a herd of healthy hogs, infect them with the acute form of the disease. Never add a new hog to your herd unless absolutely certain that there is nothing the matter with the new animal, and this should be made sure of by keeping the new hog in a separate pen for a period of three or four weeks before allowing it to enter the regular feed lot with the balance of the herd.

In the more severe cases of chronic cholera the animal continues to lose flesh and strength, and the attacks of diarrhea become more and more severe and recur with greater frequency, until, finally,

the animal becomes thoroughly exhausted, and simply dies from loss of strength. The older the animal, the less likely is chronic cholera to result in death. In some of these old hogs, after several weeks of diarrhea and loss of weight and strength, the animal begins to improve and may entirely fight off the effects of the disease and make a complete recovery.

When the chronic type of cholera attacks a young animal the tendency is for the disease to be more severe than in old hogs, with death of the sick shoat in a large percentage of the cases. When a young hog does pass through chronic cholera he is usually left with a very marked degree of stomach and bowel disturbance. As a result, the animal becomes stunted and a chronic runt. Such runts as these are never worth their keep, and it is the most economic plan to knock them in the head and thus get rid of them.

When an animal that has died of chronic cholera is opened up after death, and a postmortem examination made of the internal organs, it is usually found that the most of the changes produced by the disease are located in the bowels, and especially in the large bowel. The typical button-like ulcers are particularly common in this type of cholera. As a rule, the kidneys also are quite well spotted up, but the changes in the lungs and other organs of the chest are comparatively slight as compared with those found in cases of acute cholera.

GENERAL REMARKS ON DIAGNOSIS

Cholera being a disease that appears in different forms in each individual outbreak and in different seasons, it is sometimes rather difficult to make a diagnosis. There are, however, a number of general points which hold true in every outbreak, and if these are carefully noted there will be but little trouble, as a rule, in making a diagnosis.

When hogs have been previously in good health, and there has been no change made in manner of feeding, character of food, or housing conditions, any change from the natural healthy appearance should be regarded as suspicious. If with this change in appearance they manifest a gradual loss of appetite, hide themselves in the litter, and begin to die at the rate of one or two a day, it is

a pretty safe bet that we are at the start of an outbreak of cholera. When hogs get sick without any apparent cause in the matter of diet or housing, cholera is the most likely agent.

If, in addition to these symptoms, it is found that new animals have been added to the herd within the past few weeks, or if an epidemic of cholera be raging in the neighborhood, then our suspicion of cholera is indeed well founded, and it is almost a certainty that this disease is making a start in the herd.

If the animals are closely observed, it is quite likely that there will soon be noted the black-colored diarrhea, the cough, muscular weakness, staggering gait, swollen ears, red spots on the skin, swelling of the eyelids, sensitiveness to touch, and great thirst—all of which go to make the diagnosis more certain.

If we now open up the dead body of one of the affected animals we will be very likely to find swollen lymphatic glands which are filled and discolored with blood; enlarged, softened spleen; small pin-point red spots in the kidneys; ulceration and inflammation of the bowels, especially the lower part of the small bowel and the large bowel; redness and inflammation of the inner coat of the bladder; small red spots in the muscle of the heart, and these same small red splotches on the surface of the lungs. Our diagnosis can now no longer be in doubt. The case is unquestionably one of cholera.

It is only in those cases which have a tendency to occur at the beginning of an outbreak, where the animal shows but little evidences of being sick, and shows little or no change when opened up, that we are likely to have trouble in making a diagnosis. These cases, which have been described under the head of the very severe form, are often quite puzzling, and a diagnosis simply cannot be made without waiting for further cases to develop, or by injection of some of the blood from the dead animal into healthy pigs and awaiting the outcome.

There is another type of cases in which there may be considerable trouble in arriving at a diagnosis. These are the ones in which there are no changes to be found in the organs of the belly cavity, and in the lungs we find all the signs of a pneumonia. These cases are often puzzling, and it takes the aid of laboratory tests often to settle the matter. In a general way, however, it may be said that

pneumonia is usually a far less rapidly spreading disease than cholera, and outbreaks of pneumonia are not likely to affect the entire herd as does cholera, and neither is the disease likely to spread to other herds. A few days of close observation, together with the history of the case, will usually be sufficient to arrive at a correct conclusion.

In any instance where the question of use of serum is under consideration, and there is doubt as to whether the condition is really cholera or not, give all reasonable question of doubt in favor of the animal, and if the history and general appearances are suggestive of cholera, have the serum administered at once, even though the postmortem findings may not be absolutely conclusive.

Swine Erysipelas.—In European countries there is another very common disease found among swine which is known as swine erysipelas. This disease in some respects rather closely resembles hog-cholera, and must be differentiated from it in those countries where it exists. This distinction is made by the fact that the disease makes the animal sick in a shorter length of time after exposure; the symptoms are more severe at the time of onset; there is more congestion of the mucous membranes; cough is more severe and breathing more interfered with; while the symptoms due to disturbance of the bowels are less severe. In postmortem examination of an animal which has died from swine erysipelas there is absence of the ulcerated condition of the bowels, changes in the spleen are less marked, and we do not find the characteristic spotted condition of the kidneys which is such a common finding in hog-cholera.

TREATMENT OF CHOLERA

Management of this disease should be considered under two very broad headings: viz., preventive treatment and curative treatment. Of these two methods of treatment, by far the more important is that which has as its object the prevention of the disease. There is no other disease in which the old adage, "an ounce of prevention is worth a pound of cure," is more true than in cholera. In the management of cholera this statement is not even strong enough. Better may it be said that "an ounce of prevention is worth a *ton* of cure."

Cholera is a disease which can, and some day will, be entirely prevented. Stock owners are becoming more and more educated up to this point every day, and are commencing to recognize the fact that all that is required is a little care, and the enormous losses that occur every year can in large measure be prevented.

As is the case with human liberty, however, the price of freedom from hog-cholera is eternal vigilance. The owner must ever be on the outlook for possible sources of infection of his herd, and guard against them before the damage has been done. There is no reasonable question of doubt but what over 50 per cent. of the annual losses from cholera can be prevented by careful attention to a few simple measures, which have as their object the prevention of entrance of infection into the herds.

When we make a careful study of the many conditions which act as predisposing causes for development of cholera, we cannot help but be impressed with the fact that many of these accessory causes are due to pure neglect on the part of the owner, and if he will but become familiar with these conditions which result in his herd developing cholera he will be able to very easily make plans for preventing the invader gaining a foothold on his premises.

In the practice of human medicine truly wonderful things have been accomplished along the line of prevention of disease. Many of the diseases which were once widespread over the earth and swept away entire cities and laid waste entire empires, are now almost unknown. Yellow fever, the old time "yellow jack," which was once so familiar in our Southern States, has long since been driven from our shores. One of the most beautiful examples of what can be accomplished in the line of prevention of disease that the world has ever seen, and one that every true American citizen may well be proud of, is the results of American occupation of the Canal Zone in Panama.

It has been the dream of centuries that a canal should be constructed across the isthmus and connect the two oceans. Other nations have repeatedly tried to dig this ditch, but have been in turn forced to give up the task, owing to the unhealthy conditions which prevailed on the isthmus, and the enormous loss of life among the employees from yellow fever and other equally fatal diseases which lurked in the swamps of the Canal Zone.

When the United States Government took charge of this work, and determined to place a navigable canal across the isthmus, one of the very first things which was done was to send to the Canal Zone a corps of trained army medical officers and medical men, from the United States Public Health and Marine Hospital Corps, for the purpose of making such sanitary regulations as would make life in the isthmus safe from the diseases which had stopped every previous attempt to dig the big ditch. As a result of the steps taken by these medical men to prevent disease the isthmus was changed from a death-dealing strip to a comparatively healthy country, and the lives of the workmen on the canal are no more in danger than are the lives of workmen in our modern American city.

Very much the same thing has been done in Porto Rico, in Cuba, and in the Philippine Islands. Under the old Spanish rule Havana, San Juan, and Manila were hot-beds for yellow fever, bubonic plague, small-pox, and various other epidemics which made life in any of the cities very dangerous for the average white man. When the United States assumed control of these island possessions one of the first things done was to clean up the large cities, and, by taking proper measures to prevent disease, they have been brought upon a par with the average American city, and the lives of those whose business takes them to Manila or Havana are just as safe as they would be in New York, Philadelphia, or Chicago. Fevers and plagues, which formerly swept away thousands of lives, are now practically entirely stamped out.

What has been accomplished in this direction in human medicine can also be accomplished in the line of prevention of disease in the lower animals if we will but make the necessary efforts. Hog-cholera is a preventable disease, and it can be driven out of the United States as successfully as yellow fever has been forced out of our Southern States and the Canal Zone. We have already in the United States shown the possibilities along this line in the lower animals by the work that has been carried on with pleuro-pneumonia, foot-and-mouth disease, and other animal plagues. Foot-and-mouth disease has repeatedly invaded the United States, and only prompt work on the part of the United States officials has wiped this disease out of existence, and close supervision of

the imports of cattle into the country has prevented its reintroduction.

All that is required to produce equally efficient results in connection with hog-cholera is a thoroughly determined effort on the part of every farmer in the United States. If a co-operative effort is made by all the farmers and stock raisers of the United States, backed by the efforts of the State Live Stock Bureaus and the United States Bureau of Animal Industry, there can be no question as to the outcome. We have the weapon now at our command with which cholera can be forced out of the land. Under the direction of the United States Bureau of Animal Industry, Doctors Dorset and Niles, of the Bureau Force of Veterinarians, have perfected a method of manufacture and administration of serum which will give us a weapon in our fight against cholera which cannot but throw the balance of power in our favor.

Serum.—Hog-cholera serum is the weapon that has been needed for years to wage a successful war upon cholera, and it now only remains for us to get this weapon in sufficient quantities to carry on the campaign. It is the duty of every hog raiser, and every individual who profits directly or indirectly from the hog-raising industry, to see that our state legislatures and the National Congress appropriate sufficient funds to establish and operate serum-manufacturing plants of sufficient capacity to supply the necessary quantities of serum for immunization purposes.

In connection with the use of the serum there must be a co-operative effort on the part of every hog raiser in the entire country to stamp out the disease. Proper sanitary regulations must be made by, and enforced under the police powers of, the State Live Stock Commissions or State Veterinarians of the various states. In every community it is usually the case that we will find one or more individuals who are opposed to any new movement which is intended for the public good. This rule will hold equally good in the campaign against hog-cholera. One or two such farmers, who will insist upon allowing their dead animals to lie exposed to the attacks of buzzards, or who will allow their dead cholera animals to lie along the banks of a running stream, can scatter more cholera in a community than the efforts of all their neighbors can eradicate in a year's time. If success is to crown

our efforts we must have a strict compliance with the laws of sanitation by everyone, and where we meet with those who, through ignorance or stubbornness, refuse to take such measures as will protect their neighbor's herd from infection, then we must deal with them in no uncertain manner. These men are a public danger, and they must be taught a lesson that they will remember regarding the proper respect for the welfare of their neighbor as well as themselves.

This class of cases can be best handled by turning over to the State Live Stock Commission or other legal state officer the power to make regulations governing the disposal of animals which die from disease, and then give these officers the necessary police power to make arrests and impose fines when necessary to secure compliance with the law. These rules will not cause any hardship upon any man who is really interested in the public good, and those who are so selfish as to have no regard for the rights of others deserve to be taught a lesson. There is absolutely no use in spending large sums of money to clear certain areas of cholera, and then have the disease started up there again through the carelessness of some lazy individual, who has no care for the welfare of his neighbor, and is usually too lazy to even care what becomes of his own herd.

If we just stop for a few moments and consider the enormous losses that take place in the United States every year from cholera, we will see what an unusually hard undertaking this is, and we will also the better appreciate the necessity for a united effort upon the part of the live-stock officers of all the states and the United States Government.

Cholera Losses.—As a result of carefully collected figures for the year 1910 it is officially estimated that the losses from cholera in the United States totaled from $50,000,000 to $60,000,000. This is, if anything, a low figure, as careful estimation of the loss in the state of Tennessee during the year 1912 places the loss there alone at over $4,000,000. It is likely that a closer figure to the annual loss throughout the United States each year would be about $100,000,000.

This is estimating on the live value of the animals lost from the disease. If we take into account the value that these same animals would have if allowed to reach maturity and placed upon the

market in the form of lard, ham, bacon, and other pork products, the loss would be stated in figures half as large again as those just quoted. This is a problem that is of enormous importance not alone to the farmer, but to every line of business connected either directly or indirectly with the farming industry. The merchant, the banker, the editor, the physician, the veterinarian, the manufacturer, all depend in large measure for their prosperity upon the prosperity of the farmer. If these $100,000,000 that are being lost annually by the farmers of the United States through ravages of cholera can be saved to them it means increased business for the merchant, increased deposits for the banker, increased business for the manufacturer, and increased work and wages for the men employed in these industries.

There is another factor also to be considered in connection with these losses. This is the price of meat and meat food products. This is a point that touches the pocketbook of every household throughout our nation. The price of living is a constant source of uneasiness to every householder. Daily the price of foods, and especially of meats, is mounting higher. How can it be otherwise when millions of hogs are being swept away each year by this disease? These deaths mean just that much less of a meat supply. Less supply means higher prices. Just a little reflection along these lines will show that this is not a problem in which the farmer alone is interested. It is much more important from a national standpoint. It is a problem that strikes home to every household in the land, and one which we should all co-operate to solve.

The direct losses from the disease itself, while they may seem enormous, are only a part of what the indirect losses are. So widespread has cholera become, and so frequent its recurrence in the hog-raising states, that farmers have begun to despair of raising swine as a profitable industry, and, accordingly, we find that the farmer is no longer feeding grain into such an uncertain animal. Farms which formerly produced hundreds of hogs each year are now producing only just enough for home meat supply. Feed lots have been given over to other purposes, and in many localities the swine-raising industry has almost entirely disappeared.

Yet all these losses are preventable. The entire plan of suc-

cessful hog-cholera eradication has been worked out and is now at the command of every state in the Union. All we need to accomplish results is a strongly organized campaign of eradication carried on at the same time in every state, in every county, and in every township. Cholera has met its master, and is destined to be driven from our country just as surely as has yellow jack, foot-and-mouth disease, and other human and animal plagues that have from time to time gained a foothold on our shores.

Preventive Measures

Those predisposing causes which depend upon age and sex of the animal are of no importance from the standpoint of prevention of the disease, except that the young animals should be especially cared for and protected from those conditions which tend to favor the development of cholera in the herd.

Breed.—Again I would state that there is nothing to be gained in prevention of cholera by the development or breeding of any special breed of hogs. Poland-China, Hampshire, Duroc, Chester-White, and even the Razor-back and Mulefoot animals are all about equally susceptible to the attack of the cholera germ, and the death-rate is equally high in one breed or the other. Too close inbreeding should be avoided, as this tends to lower the natural resisting powers of the herd, and fresh stock should be introduced from time to time to avoid this degeneration which follows close inbreeding from the same strain in several successive years.

Feed Lots.—Here is where the owner can begin to take such steps as will result in actual good. Feed lots for hogs should be kept just as clean as possible. No filth or dirt should be allowed to accumulate and afford harboring places for the germs of disease. Mud-holes are just as unnecessary in the hog lot as they are in the dooryard, and should not be tolerated for an instant.

Hog yards are only too common in the hog-raising belt where the animals have to wade about in mud up to their bellies and grope for their food in this same mud and mire. Concrete or board feeding floors should be provided for use in muddy weather, and the hog lots should be so drained that there is never a collection of mud and mire even in rainy weather.

In place of the time-honored mud-hole hog wallow provide a sanitary concrete wallow, in which the animal will be able to take a cleansing bath and at the same time enjoy the contentment of coolness and comfort. An excellent example of a modern sanitary concrete hog wallow is shown in Fig. 39.

Give the hog a chance to keep clean by providing him with a clean lot in which to exercise, feed him on a clean floor, and provide him with a sanitary wallow in which to bathe, and you will soon come to the conclusion that instead of being the dirtiest of animals he is one of the cleanest.

Fig. 52.—Concrete hog wallow in pen of State Serum Plant, Nashville, Tenn.

Hog lots should always be properly fenced, so as to keep the animals from getting out and straying along a public highway. Cholera hogs are continually being transported to market along these public roads, and they are constantly leaving behind them a trail of disease-producing material. If your hogs get out into the public road, and come in contact with these infectious discharges, they are just as certain to contract cholera as day is to follow night. Properly fenced hog lots also prevent stray animals from entering, and keep out dogs, cats, and other prowling animals, any of which may carry the disease to your herd.

Sleeping Quarters.—Here also a little attention and exercise of common sense will prevent enormous losses, not only from

cholera but also from pneumonia. Swine are often crowded together in most insanitary, drafty, and overcrowded quarters. In such cases the animals huddle together, becoming overheated; and then, when aroused from the litter at feeding time, become chilled by exposure to drafts of chilling winter air. The result is, they develop bronchitis, a cough, and finally they become so lowered in resistance that they readily fall easy victims to cholera or any other infectious disease that may make its appearance.

In many cases the animals are allowed to burrow under a straw stack in winter. Here they become overheated, the air breathed is most impure and filled with dust, and the animals come out in the morning overheated and coughing. Exposure to the sudden

Fig. 53.—Sanitary hog house on farm of J. H. Dunlap, Williamsport, Ohio.

change of temperature results in chilling, cough, and often pneumonia. In those cases which do not develop pneumonia there is a weakening of the resisting power of the animals to disease, and the introduction of cholera virus from any source quickly leads to an outbreak of the disease.

Sleeping quarters should be provided in which it will be impossible for the animals to overcrowd. They should be properly bedded with suitable litter, and so ventilated that the hogs receive a good supply of fresh air, and at the same time are protected from cold drafts. In this way the animals do not become heated up at night and chilled in the morning, and we are able to prevent chronic irritation of the lungs and bronchi, and the resistance of the herd is built up instead of weakened.

Water-supply.—Perhaps this is one of the most important single factors in the prevention of cholera. Hogs should never be allowed to run in a pasture where there is a running stream which receives drainage from other hog lots higher up along its course. It has already been shown how readily these streams may become the carriers of hog-cholera infection, and we usually have no way of knowing when animals are dying several miles up stream, and no way of knowing whether the stream is becoming infected or not.

Sanitary drinking troughs, preferably of concrete or metal, should be provided, and the animals should have constantly before them a plentiful supply of fresh, clear water, both for drinking and

Fig. 54.—A model piggery at "The Cedars" farm, Columbus, Ohio.

wallowing purposes. In the winter months the drinking-water should be heated, so as to bring it to a temperature comfortable to drink. Water is one of the greatest cleansing agents that we possess, and both man and animal should use large amounts of good, clear, fresh water, both internally and externally. Drinking of plenty of fresh, clean water washes out all the tubes and canals of the body and keeps them clean and free from accumulations of disease-producing, stagnant matter. Hogs will not drink enough water if it is so cold as to chill the body when swallowed. Give a little attention to this small point of comfort, and the animal will many times repay you by increased health and increased results from the same amount of food eaten.

One of the worst outbreaks of cholera that I have ever seen was spread through the agency of a running stream. Early in the spring a farmer living along the banks of this small creek purchased some hogs at a public sale. These were immediately added to his regular herd, as they were apparently in good health. About three weeks later several of the animals of the regular herd became sick and in a few days began to die. The course of the disease was rather of the subacute variety, but postmortem findings were unquestionably those of cholera.

As this was a very busy season of the year, the owner was rather careless in the disposal of the dead animals, and, as a result, several of them were left lying in the field where the bodies were devoured by other animals and by a large flock of buzzards which were attracted by the opportunity for a feast. The pasture in which the animals were kept was crossed by this small stream, and a rain which fell about this time washed large amounts of infectious material into the creek.

Lower down in its course this stream passed through a number of other pastures, and in the course of two weeks' time animals on the farms down stream began to exhibit evidences of cholera. Within a month there was a widespread outbreak of cholera, involving the herds for miles down the stream. Several nighboring farms, located back from the creek banks, were infected by the buzzards which were attracted to the locality by the exposed dead animal carcasses.

This outbreak illustrates several points in the prevention of cholera. In the first place, it shows the danger of adding new hogs to the herd without first properly quarantining them for at least thirty days to see if they are free from hog-cholera or other disease transmissible to other animals.

Second, it illustrates the danger of allowing hogs to range in pastures which are crossed by a running stream, and especially so if this stream receives drainage from other hog lots higher up in its course, and they nearly all do. This is a danger which cannot be overlooked, as running streams may carry the infection for several miles and infect hogs in pastures at a great distance.

This outbreak also illustrates another danger in the spread of cholera. This is the effect of leaving dead carcasses exposed in

the open field. Such carelessness inevitably attracts the ever-ready buzzard, and when buzzards begin to appear in a neighborhood it is a signal of danger and means a rapid scattering of the disease.

No matter how busy the season of the year, it will always pay to take time to burn these dead animals, whether they be hogs, horses, cattle, sheep, dogs, chickens, or what not. It is a duty that every man owes himself and his neighbor as well. If for any good reason, such as sickness, a man is unable to attend to this duty, his neighbors should, if necessary, volunteer their aid in helping him in other directions, in order that he may be able to properly dispose of the dead carcasses. So important is this matter of burnind dead carcasses that it should be considered as a public duty, and every man should make it his business not only to do it himself, but to see that his neighbor does it as well. Any obstinate refusal to take proper measures to thus prevent spread of disease to other herds should be reported to the proper officials, and made the subject of police action on the part of the State Veterinarian or the local authorities.

In this instance just mentioned the carelessness of one individual in this respect resulted directly in the spreading of an epidemic along this valley which resulted in total losses of close to $100,000, all of which could have been prevented by a proper knowledge of the dangers of such practices and the manner in which cholera can be and is spread.

In writing this book I have particularly the desire to show the reader just how cholera is carried from one herd to another; how rapidly and easily it may be scattered through a little carelessness or neglect on the part of one or two individuals, and likewise how readily it may be prevented by a little care and caution properly applied. If I accomplish this I feel that I will have performed a great service to the American farmer, and will feel amply rewarded for the effort which it has required to get all the material together with which to prepare this volume. At the same time I shall feel that I have accomplished a great deal in the prevention and eradication of hog-cholera, for if stockmen just get a thorough understanding of the nature of the disease, the character of the infection, the manner in which it is spread, and the measures necessary for its

prevention, they will have far less cholera, far less losses from the disease, and these precautionary measures when combined with the proper use of a reliable hog-cholera serum should rapidly wipe out the disease in any given locality.

In the summer of 1911 I had occasion to see an outbreak of hog-cholera due to impure water which was brought about in the following manner. This outbreak started on the farm of a renter located along the course of a shallow creek which flowed for several miles through a rich farming community on its way to a small river. As is usually the case, numerous hog lots were located along the course of this stream.

The farmer in question, however, did not have his hog lot located on the stream, but it ran through a small woods pasture about a half-mile from the hog lots. Early in the spring his animals began to get off feed, and in a few days had developed a typical outbreak of cholera. Just how they contracted the disease I was not able to find out. In the course of a week they were dying in bunches of 5 or 6 every day. At first he undertook to bury the dead animals, but when they began to die in such large numbers he found that it occupied too much of his time to dispose of the dead carcasses in this manner, and so he devised an easy method of disposing of them.

Every morning he hitched up a team to a wagon and drove through the feed lot and gathered up the dead. They were then hauled down across the field to the woods pasture and dumped into the creek. Here the bodies rapidly decomposed and were swept away by the current. The woods were soon filled with an enormous flock of buzzards and crows, which also aided in the disposal of the carcasses, and, incidentally, in the scattering of the disease.

The results of this method of disposal of the dead carcasses are not hard to foresee. The decomposing and rotten dead animal tissue, laden with hog-cholera virus, was swept down the creek and through dozens of other hog lots lower down in its course. In about ten days other herds along the course of the stream began to show signs of illness, and in a fortnight the outbreak was in full swing, involving over fifty herds along the course of the stream. The buzzards and crows served to carry the infection to the farms

located back from its banks, and the outbreak soon covered a radius of several square miles and involved a loss of thousands of animals.

Here, again, we have an example of an outbreak which was brought about by pure neglect and ignorance of the methods of spreading hog-cholera. Had this man known that the hog-cholera virus would be spread through the water of this creek into which he threw the dead carcasses it is not likely that he would have wilfully

Fig. 55.—View of rear of country slaughter-house. Note drainage passes down into small stream. This is one of the methods of spreading hog-cholera. No community should permit such conditions to exist (U. S. Bureau Animal Industry Reports).

sent the disease speeding down stream to destroy the herds of his neighbors We must all learn the dangers of such practices, and see that our neighbors become educated along this line also, in order that such carelessness, which borders on the verge of being criminal, shall be avoided.

In the eastern part of central Illinois a few years ago a slaughter-house was erected just outside the city limits of one of the prosperous small cities of the farming belt. As is very frequently the

case, this slaughter-house was located back in a hollow near the banks of a small creek. This creek wound on down through the farmlands for several miles, affording water-supply to a large number of feeders along its course.

This slaughter-house disposed of its animal refuse by simply washing it off into the creek and allowing it to carry down along the course of the stream. This, by the way, is a very common custom in nearly every small city throughout central Illinois and Indiana. The local butchers usually do a great percentage of their own slaughtering, and the slaughter-houses are usually located in some little wooded gully at the outskirts of the city, and the waste matter is either thrown directly into the creek or is thrown into a hog lot which drains into the stream.

Early in August an outbreak of cholera occurred in a neighboring county, and the owners of the local slaughtering plant saw an opportunity to buy some cheap hogs, so they went over into the adjoining district and bought several loads of hogs which were apparently healthy, but which the owners were afraid would contract the disease, and, accordingly, were willing to dispose of below the market price for quick sale.

These animals were brought in and killed at the local plant and the offal disposed of in the usual manner. As there was no local meat inspection, there is no way of absolutely telling whether or not these animals were affected with cholera, but the after-results along the course of the stream evidently bear out the opinion that at least some of them were infected with the virus of hog-cholera.

About two weeks after these hogs were brought in several of the feeders along the course of the stream began to note evidences of disease in their herds, and it was only a few days until there was a full-fledged outbreak of typical hog-cholera in full swing along the course of the stream, which had been undoubtedly contaminated from the offal thrown into it by the butchers at the slaughtering plant.

This case serves to present a number of interesting problems in the prevention of hog-cholera, and also, incidentally, in the proper regulation of local slaughtering plants.

In the first place, it should be made an offence punishable by law to locate a slaughtering plant along the course of a public

waterway, as in this case, and allow the offal to be thrown into the stream without any precautions being taken to render it harmless to animals drinking from the stream lower down in its course.

Another point illustrated in this case is the need for some well-regulated system of local meat inspection. There can be no question but what in this case one or more hog-cholera carcasses were slaughtered, and were taken into the city and sold as food to patrons of the market. This is taking place every day in the smaller cities of our country, and is taking place not only in respect to cholera, but also with respect to tuberculosis and other diseases which are directly transmissible to man.

Almost conclusive proof of this fact was later given in this particular locality, when a farmer located at a considerable distance from the stream mentioned, but who was feeding his hogs with swill collected from a local restaurant owned by his son, had an outbreak of cholera occur on his farm. This restaurant was supplied with meat from the butcher owning the slaughtering establishment in question, and there was little question but what the disease was conveyed to this farm through infected meat trimmings collected with the garbage from this restaurant. Of course, the infection may have reached the farm in some other manner, but the circumstances in this outbreak were such as to point almost conclusively to the meat trimmings as the source of infection.

Every city of 10,000 or more should have one central slaughtering establishment, which should either be owned by the city or co-operatively by the men engaged in the meat trade in the city. This plant should be under the close supervision of the health department of the city, and should have a qualified inspector located at the plant at all times when any slaughtering is being done.

This plant should be sanitary in every respect, and should not be an old tumble-down shack located back in some hollow along the course of a creek, sufficiently far removed from the roadway to prevent the smell of its reeking contamination being detected by passers by. Did you ever notice that a slaughter-house is usually located back a half-mile or more from any public road? Did you

ever stop to think why this is done? It is simply because most of these places are so filthy and dirty, and emit such an abominable stench, that if located near the public highway they would be declared a dangerous nuisance and the owners would be forced to clean up. Yet we are eating meat every day which is slaughtered in these dirty holes by butchers who are often not much more cleanly than the plants in which they are working. These conditions should not be tolerated. A slaughter-house can be kept clean just as well as any other place of business, and the residents in every community should make it their business to see that it is kept so. The city residents who eat the meat should insist that their food be handled in a cleanly manner in a clean place, and farmers should be equally strong in insisting that the disease-carrying offal from these establishments shall not be thrown into the creeks and rivulets to carry disease to the herds along its course. There is no reason why the farmers of this country should suffer hundreds of thousands of dollars of loss every year just because it will cost the butchers a few dollars and a little effort to keep their slaughter-houses clean.

As a matter of actual fact, a central slaughtering plant, owned either co-operatively by the butchers or by the city and conducted on a self-supporting basis by charging so much per head for each animal dressed, is in the end cheaper than a number of small private plants, far more sanitary and convenient, and insures a clean, wholesome meat-supply to the city.

As another example of how easy it is for a stream to become contaminated with the virus of cholera, even when it is not directly infected by the dead bodies of cholera animals, I would call attention to the following outbreak which occurred in southern Wisconsin a few seasons ago:

The outbreak occurred in a wealthy farming community, in which there was the ever-present small stream, which flowed through the pastures and feed lots of a number of farmers and stock raisers along its course. The farm on which the disease first made its appearance, however, was not located directly upon the course of the stream, but upon a hillside, nearly a quarter of a mile above. Here the disease made its appearance during the winter months when the ground was covered with snow, and, while

of a mild form, it resulted in the death of a large number of animals before it finally run its course in the early spring.

At the time there was no further spread of the disease, as this farm was somewhat isolated from its neighbors, and the owner was not one of an overly sociable nature, and accordingly had little communication with his neighbors.

The dead carcasses were disposed of by burying in a shallow trench which was dug just outside the feed lot on the bank of the hill. As the ground was frozen at the time, and grave digging was a rather laborious job, a number of the carcasses were simply buried in the snow and left to be otherwise disposed of in the spring.

As a result, when the snow melted in the spring it carried with it down to the creek in the valley below large amounts of infectious material. This entered the stream and was carried rapidly along its course to the farms below. In the course of a month after the spring thaw began there was the starting of an outbreak on these farms, and with the coming of warm weather the virus seemed to gain new vigor, as the type of disease now produced was of the decidedly acute type, and the losses ran high.

All these examples go to show the many ways by which a running stream may become a source of spreading the disease. It does not require much reasoning to see that any advantages which such a stream may offer as a convenient source of water-supply are more than overbalanced by the great dangers to which it exposes your animals, and especially hogs.

The shallow running stream is by no means the only dangerous source of water-supply. In digging a well for supply of water for stock it is only too commonly the practice to locate it in some hollow or low spot, where water can be found with the least possible amount of effort. As a result, we have all throughout the stock-raising district a large number of these shallow wells which receive the drainage from barn-lots, feed yards and outhouses, as well as a large amount of surface water, which is always contaminated. In addition to these sources of contamination very frequently these shallow wells are none too tightly covered over, and during the winter a large number of rats, rabbits, and other small animals get into the well and are drowned therein.

This can have only one result. The water supplied from such wells is a menace to both man and animals, and large numbers of live stock and not infrequently a large number of human lives are sacrificed from this source.

Last summer I had the opportunity of observing an epidemic of cholera on a farm in western Illinois which was most likely started from impure water obtained from a well of this character. The farmer in question had a herd of about 100 hogs which he had been keeping on a pasture nearly a mile away from the well which proved the source of the disease. This well was located in a hollow, about a quarter of a mile below a neighbor's hog lot, and received the drainage from this lot as well as a large amount of surface water.

During the early summer the neighbor's hogs developed cholera and died in large numbers. As the first-mentioned drove of hogs was nearly a mile distant, there was no spread of the outbreak to them. Finally, toward the latter part of the summer, the water-supply in the pasture where these hogs were kept began to fail, and the owner started hauling water from the well in the hollow. About ten days after he started to bring water from this well his hogs began to show signs of sickness, and in the course of about two weeks several had already died. The source of the epidemic was never suspected by the owner, but I am convinced that the true cause of the outbreak was this water, which was brought from the well which had been contaminated by seepage from the infected hog lots located on the hillside higher up.

Several years ago I remember, while living on a farm in western Illinois, that a neighboring farmer had a well of this kind which had been sunk in a low bottom land and which provided an ample supply of water at a depth of about 14 feet. This well was loosely covered at the top, and was used merely for the supply of water to a herd of cattle which were pastured in the field surrounding the well.

Along in the early spring a new herd of cattle was turned into this pasture to graze, and in a couple of weeks after they had been placed in the pasture several of them began to show evidences of indigestion and diarrhea. One or two of the animals became very sick, and finally one of them died. On postmortem examination the carcass revealed a diffuse inflammation of the intestinal canal

throughout its entire length and a very diseased condition of the contents of the bowel.

Suspicion was first directed to the grass in the field, it being believed that it perhaps contained a poisonous weed of some unknown kind. By some chance, however, it was decided to investigate the condition of the well. The cover was removed, and, lo and behold, the surface of the water was found to be a floating mass of dead animal bodies, There was removed from this well fifteen rabbits, one cat, two dogs and a half-dozen rats, and several mice. This mass of stinking, decomposing dead bodies had been rotting here for weeks, and the toxic matter so generated had been carried to the stomach of the cattle through the water. It was no wonder that they developed an inflammation of the bowels and died. The wonder is that the entire herd was not wiped out by the poisons so formed.

Losses from impure water are by no means always confined to the hogs and cattle on the premises. Typhoid fever, one of the most dread diseases to which man is heir, is nearly always transmitted through impure water. Wells so located that they are below the level of outhouses constantly receive the seepage from these cess-pools, and become breeding places for the typhoid bacilli which causes the disease in man. Anyone drinking this water is exceedingly liable to develop typhoid, and large outbreaks have been started in just this manner.

A few years ago in eastern Iowa a farm hand came to work on a certain farm. He had come out from one of the nearby cities where he had been employed in a large factory. A few weeks after his arrival he began to show signs of sickness, which were not very marked at first. He gradually became more and more indisposed, and finally was down sick in bed. The case eventually developed into one of true typhoid.

On this farm, as is usually the case, the house was located at the highest point on the farm, and the well located about a hundred yards further down the slope toward the barn. The outhouse was located a few yards back of the house. The discharges from the patient were emptied in the outhouse all through the attack of the disease. The case ran the usual course, and finally attacked two other members of the same family.

During the following summer a threshing crew was working on this farm for two or three days, and while there drank freely of the water obtained from this well. About three weeks later a number of the men who had been in this crew began to feel indisposed, and within a month nearly a score of cases of genuine typhoid had developed as a result of this one contaminated well, and

in the end three deaths were directly traceable to this one improperly located well. The water here had become contaminated by seepage from the outhouse vault, and the germs had remained virulent for several weeks, producing disease in healthy individuals at this late date.

On dairy farms there is an added danger in wells of this kind, in that the water used for washing the dairy utensils, if impure, will transmit disease germs to the milk. Milk is one of the finest of all culture-media for disease germs, and they rapidly reproduce, causing disease in those who drink the milk. Typhoid fever epidemics are thus started often in cities located hundreds of miles away from the source of original contamination.

In the fall of 1900 there occurred an outbreak of typhoid fever at the Iowa State Agricultural College in Ames, Iowa, which illustrates very clearly the dangers in impure water in transmitting disease among human beings.

The milk used at the college had for a considerable period been furnished by two farmers—Sketon and Pritchard. On account of increased demand it was necessary to add another farmer to the list. Farmer Briley began supplying milk to the college September 3d. On October 8th the first cases of typhoid began to appear at the college. The epidemic rapidly spread among the student body and assumed large proportions in a few days. All the cases of typhoid occurred among milk drinkers.

At the training table of the foot-ball squad there were sixteen players. These men, as a part of their regular training, were encouraged to drink plenty of milk. Thirteen of these sixteen men contracted the disease. No cases of typhoid were found among those members of the student body who did not drink milk.

An investigation was made, and attention directed to the milk-supply. No cases of typhoid had occurred on the Sketon or Pritchard farms, but it was discovered that a daughter of farmer Briley had been ill with typhoid during the month of August. Her bowel discharges had been emptied into the cesspool of an outhouse a short distance from the house and located at a higher level than the well.

Examination of the water from the well revealed the fact that the water had been contaminated by seepage from this cesspool, and microscopic and bacteriologic examination of the water demonstrated the presence of the specific germ which produces typhoid fever. Water from this well had been used for the purpose of washing out the milk cans which were needed for conveying the milk to the college. As a result, there had been the development of typhoid germs in large numbers in the milk, and consequent infection of the students who drank this infected milk.

Milk from this dairy was discontinued on October 17th, and a little over two weeks later the last case of typhoid was taken ill at the college. These cases which developed within the two weeks after discontinuing milk from the Briley farm had already become infected by germs from this milk, and the disease made itself manifest at the end of the usual incubation period.

Hundreds of similar typhoid epidemics have occurred at various times throughout the United States, and in a great majority of these cases water polluted by sewage or seepage from an outhouse

cesspool has been determined to be the real cause of the outbreak. In many epidemics the disease is contracted by simply drinking the polluted water; in other cases it is transmitted through milk which has been contaminated on the dairy farm by this impure water. It is well to bear in mind, then, that in protecting your water-supply, and so locating your wells as to prevent their becoming contaminated by seepage from cesspools, you are not only protecting the lives of your live stock, but also the lives of yourself, your family, and other individuals as well.

When cholera is in the neighborhood it is often a most excellent plan to add some antiseptic substance to the water for the purpose of ridding the stomach and bowels of any infectious material which may enter with the food. A small expense in this direction may often prevent large losses from disease.

Food-supply.—Herein lies the greatest danger of all to the healthy animal, and the greatest possibilities for good in prevention of the disease. Probably 90 per cent. of the outbreaks of hog-cholera are directly traceable to the eating of some disease-producing material by the healthy animals. This infection may reach the food in a great number of ways, some of which are hard to control, but the more important are the following:

Never allow your animals to feed upon the carcass of any dead animal; especially, never allow them to feed upon the dead bodies of hogs which have died from cholera. To do so is practically to ensure the outbreak of the disease in those eating of the carcass. However, hogs should not be allowed to feed upon any dead animal carcass. While it is true that no other animal but the hog is affected by cholera, and the animal cannot possibly get cholera from the meat of some other animal, yet these dead bodies do contain other disease germs which may attack the hog, such as tuberculosis, and these diseases lower the resistance of the animal and make it the more ready victim to the inroads of cholera.

Another danger never to be forgotten in connection with the exposure of a dead animal carcass of any kind, be it horse, cow, sheep, hog, or what not, in the hog lot, is the attraction of turkey buzzards and carrion crows by the smell of a feast. These birds can scent a dead carcass for miles, and will come great distances to feast upon any dead carcass that may be exposed. These birds

always bring with them the germs of infection. They collect wherever cholera is found and they carry with them to other pastures the disease-producing material of the disease. Make it an unbreakable rule never to leave a dead animal carcass exposed in your feed lots or hog pastures.

Feeding of swill collected from hotels and restaurants and city dwellings is another great danger in the spread of hog-cholera. This swill almost invariably contains pieces of bacon rind, ham trimmings, bones, and other refuse from pork. These scraps very frequently come from a hog-cholera carcass in which the lesions were so slight that the carcass is passed for food, or they may come from animals which were slaughtered in packing plants where there is no government inspection. In these latter cases these meat trimmings very often carry large amounts of disease-producing cholera germs, and will very quickly infect your herds. If you are going to feed swill collected from these sources, lessen the danger by placing it in a large open kettle and boiling thoroughly before using, so as to destroy any infectious material that it may contain. Even then you are running a risk in using this class of food.

Dirty, rotten foods of all kinds should be thrown out in feeding swine if you desire to keep them healthy. You cannot expect a hog to keep healthy on food that is so stinking and rotten that no other animal will eat it. Keep your swill barrels reasonably clean, and treat the hogs on your farm with some regard for cleanliness and wholesomeness of food. These dirty, decomposing foods may not produce cholera in themselves, but they do produce gastro-intestinal disorders, especially in young pigs and shoats, and these open the way for entrance of cholera germs and the outbreak of a fatal epidemic of the disease in animals which might have been able to throw off the invaders if their stomachs and bowels had been kept in good condition by proper food.

In the slops that come from the kitchen there are often included considerable amounts of soap, salt brine, and other irritating substances, which have a very harmful effect upon the gastro-intestinal tract of the hog, producing subacute and even acute inflammations, with diarrhea, vomiting, and loss of appetite. Frequently these disturbances are so marked that the animal dies of the attack, and many of these cases are set down as deaths from cholera, when,

as a matter of fact, the death was really due to acute poisoning. In other cases the animal recovers from the effects of the poisons, but the intestines are left in such an inflamed state that they are readily invaded by the hog-cholera virus, and a few weeks later the animals again become sick and die rapidly, this time from a true hog-cholera infection.

During my investigations of hog-cholera in the Dominion of Canada a few years ago I saw a number of cases of excellent examples of infection produced in this manner.

One farmer, living about four miles from town, had a herd of nearly 100 fine animals, which had been thriving most satisfactorily all through the spring and early summer. None of them had been sick, and every animal in the herd was doing fine. About July 1st he began feeding the animals with swill collected from hotels and restaurants in the city. For a few days the herd continued to do fine, and, in fact, seemed to be thriving even better than before. About the end of the second week after commencement of feeding of swill several of them began to get off feed and develop a diarrhea. This was at first merely of a profuse watery character, but within a few hours became of a bloody nature. Several of the sick vomited and developed a high temperature. Death took place in quite a number, and postmortem examination showed a most severe inflammation of the stomach and both large and small bowels. There were, however, no ulcers, no dark red spots in the kidneys, no reddened spots in the lungs, or other evidences of cholera. The animals had died simply from an acute gastro-enteritis, produced by feeding of poisonous substances in the food collected from these hotels and restaurants.

On recommendation of the local district veterinarian the feeding of swill was discontinued, and the animals were soon back in normal condition.

Another farmer in the same locality had a large herd of hogs which had been running for a considerable time on a grass range, with the additional feeding of some corn and middlings. About three weeks before I saw the herd he began feeding the animals with refuse from a number of city homes, including one hotel and a number of restaurants. In the swill and refuse so collected was a considerable amount of bacon and ham trimmings and other pork

products. About fifteen days after commencement of this line of feeding one or two of the animals were noticed to be sick. The next morning one or two more were off feed, and in a few days over half of the herd were sick. These sick hogs showed the following symptoms: They refused food; they remained huddled off in corners of the feed lot; breathing was rapid and the surface of the body hot and dry. Those that were first taken sick showed evidences of marked muscular weakness, especially in the hind extremities. The walk was staggering, and one animal was unable to rise at all. The eyes were swollen and discharging a profuse yellowish discharge. Marked tenderness was exhibited over the entire body and especially over the belly. Food was absolutely refused, although the animals would still drink water. There had been no diarrhea as yet, and most of those that were sick showed instead a marked constipation.

One of the sickest animals was killed and a postmortem examination made. The lymph-glands in the flank and under the jaw were found to be markedly swollen and softened, and showed spots of blood-red color throughout their substance. When the abdominal cavity was opened the entire bowel was found to be acutely inflamed and reddened. On opening the stomach its inner surface was found to be acutely inflamed, and the organ also contained a large number of worms. The small intestine was a bright red color, both inside and out, being engorged with blood and decidedly red in color. In the lower portion of the bowel there were found a few beginning ulcers. At the base of the ileocecal valve a number of small grayish-colored elevated spots were found, and when these spots were brushed off, an ulcerated surface was uncovered beneath.

The large intestine was of a deep port wine color and very soft, being easily torn. On cutting into this portion of the bowel several ulcers were found along its course. The spleen was enlarged and dark in color. The liver was somewhat swollen and softened. When the kidneys were removed from their capsule, one of them was remarkably enlarged, soft, and on its surface showed a regular pepper-and-salt sprinkling with small dot-like red spots. On cutting into the kidney its cut surface was engorged with blood and also showed a large number of dark red spots. The lungs

and heart in this case were practically unchanged, except for a somewhat well-marked flabbiness of the heart muscle.

The case was unquestionably one of cholera, and the source of infection was undoubtedly from the bacon rinds, ham trimmings, and other pork products brought out from the city. These undoubtedly in part were originally derived from animals that had suffered from cholera.

Another case, which gives an example of this same source of infection, was seen in central Illinois. The previous fall the farmer who owned this herd of hogs had had an outbreak of cholera on his premises. He had selected 3 animals which apparently were in good health, and had slaughtered them at once for his own meat. The balance of the herd had been shipped to market. The pens were unoccupied by hogs during the entire winter. In the spring he purchased 20 shoats at a public sale and brought them home. They were placed in the pens previously occupied by the cholera herd. They remained there for several weeks, apparently doing fine. No evidence of cholera or any other disease was to be seen. About this time he found one of the hams which had been cured during the winter was apparently a little sour. This ham was thrown out into the hog lot and eaten by the hogs. About fifteen days later three or four of the shoats came up missing at feeding time. Search found them burrowed in the litter of the sleeping quarters. They were aroused and driven up to the feeding troughs. They showed little inclination to eat, however, and soon returned to the pens, where they again burrowed under the litter. The next morning one of these animals was dead. Postmortem showed typical signs of acute cholera. Especially marked were the dark red spots in the kidneys, blood-colored spots in the lymph-glands, and also in the lungs. The farmer was of the opinion that the animals contracted cholera from the previously infected pens. While this would have been possible, the evidence is much more conclusive that the source of infection was in the infected ham which had been fed about two weeks previously. The animals had already remained in the pens several weeks—much longer than the usual incubation period for cholera—while the period elapsing between the feeding of the ham and the development of symptoms was just about the average incubation period of cholera.

In central Illinois a few year ago the proprietors of a certain slaughtering establishment maintained a considerable herd of hogs, which were fed largely upon the offal from the slaughter-house. At this time the firm was slaughtering only cattle and sheep, the pork products being purchased from one of the large packing houses at Chicago.

About the first of June the firm began slaughtering swine as well as beef and mutton, and, as before, the offal was fed to the hogs. There was no noticeable change for several weeks, until a shipment of hogs was purchased from an adjoining county. One of these animals died in the pens while awaiting slaughter, and the carcass was thrown over into the hog lot to be consumed by the herd.

About ten days later three of the shoats were sick. They seemed better, however, the next day, and from this time on there was a gradual development of unthriftiness in the herd. They developed a cough, were irregular in appetite, lost weight instead of gaining, had alternating periods of constipation and diarrhea. Finally all were slaughtered except one or two of the sickest of the herd. As there was no inspection at this plant the meat passed into the usual markets. I had opportunity to examine the carcass of one of the animals which remained in the pens. The animal was very poor in flesh and practically all the natural body fat had disappeared. When the stomach was opened several ulcers were found on its mucous lining. The lower part of the small bowel was freely studded with ulcers, while the ileocecal valve was simply one large ulcer. In the large intestine several ulcers, varying in size from a pea to as large as a quarter-dollar, were found. The kidneys were shrunken and dotted with red-colored spots. The spleen and liver were not markedly affected, and there was but little change in the organs of the thoracic cavity.

The case was unquestionably one of chronic cholera. These animals were, without doubt, infected from the carcass of the dead animal fed to them weeks before. By continuous life around a slaughter-house they had developed a gradual resistance to disease germs, and had been able to fight off the infection fairly well, the result being a chronic cholera rather than the acute type.

All animals require a certain amount of variety in the food

supplied them if they are to do well. This applies to the hog as well as to the other animals, and even man. If you were to live upon an exclusively meat diet for several weeks, your stomach and bowels would soon show the effects of the lack of proper variety in food. An excellent example of this is often seen in sailors who are away from land for several months and have no fresh food of any kind. Scurvy breaks out in severe form, and large numbers of them frequently die. This is, in effect, practically what many farmers do with their hogs.

You will often see a farmer who is crowding his animals with a strictly corn diet, and the poor hog gets nothing else day after day but corn. Corn is an excellent food; of this there can be no doubt, and hogs usually do well on it; but, if given exclusively, and with no other food to form a variety, it will invariably lead to trouble. Indigestion, diarrhea, constipation, loss of appetite, and other digestive disturbances are certain to develop.

These, in themselves, are not sufficient usually to produce the death of the animal, but they do prepare the field for the sowing of the seed of cholera infection, and if the animal becomes infected it is in a very poor condition to fight the disease, and, as a result, cholera when it breaks out in these herds runs a very rapid and exceedingly fatal course.

Especially use care when commencing to feed some unusual food. As, for instance, when starting to feed green corn in the fall. We have practically all of us seen and experienced the effects on our own body, and especially our stomach and bowels, of overeating with some green food, such as green corn, green apples, etc. The stomach of the hog is not greatly different from our own, and the results are very much the same when excess is practised. Diarrhea, colic, and indigestion are sure to follow if carelessness is not avoided in this respect. Every case of indigestion invites cholera to come in and take possession, and cholera is one of those diseases which seldom needs a second invitation.

In northwestern Iowa a few years ago I had occasion to see some severe losses which were brought about in this way.

One case that I remember well had about the following history: The farmer, a large stock raiser, had a large herd of hogs which had been running for several weeks on a timber pasture and had

thrived remarkably well. He decided that he would now pen them up and force feed for a few weeks preparatory to shipment to market.

The animals were, accordingly, removed from the pasture range and crowded into a couple of small feed lots, where there was no room for exercise and no sign of green food of any kind. He immediately began feeding dry ear corn and shell corn, which was prepared by soaking and boiling in a large open kettle. At night the animals huddled into a long narrow hog house which was drafty, poorly ventilated, and had practically no light even at midday. The animals did well for a few days, and then he began to note that a few of them were not so vigorous in scrambling for food as the others. In another couple of days these animals were entirely off feed. He decided that the trouble was worms, and so gave the entire herd a large dose of tobacco and copperas. This set up a marked diarrhea in a number of the shoats and, as a result, within a week he had several sick animals and one dead. Post-mortem examination of this animal showed the usual signs of an acute inflammation of the bowels. The entire lining of the stomach and intestines was inflamed and reddened in appearance. There were no ulcers to be found, no little red spots in the kidneys, and no hemorrhagic lesions in other parts of the body.

Change in the feeding system was recommended, the animals given a wider range, the herd separated so as to avoid overcrowding, and in a few days the hogs were back in a healthy condition. Cholera did not break out in this herd, but, if any hog-cholera virus had been introduced from outside it would have found a most inviting opportunity to clean out the entire drove.

Another case somewhat similar was seen in the western part of Illinois a few months ago. The owner, a large stock farmer, had over one hundred head of hogs on full feed of corn. Suddenly they began to get off feed and three were found dead in the morning. The animals refused food, had a marked watery, and in some cases blood-stained, diarrhea, and a few had vomited. The sick animals showed a general disinclination to get about, but no specially marked muscular weakness in the hind limbs. Temperature was high, no cough, and no marked difficulty in breathing. The owner was certain the animals were taking down with cholera.

Postmortem examination showed changes very similar to those described above. The stomach was acutely inflamed and contained a large number of worms. The small intestine was especially discolored in appearance, and the lining membrane of the large bowel was also inflamed and reddened. No ulcers were to be found, however, although most careful search was made. The kidneys showed no dark-colored spots, the spleen was slightly enlarged, but about natural in color. No changes in the bladder and the condition of the liver practically normal. One of the carcasses showed a slight pneumonia in the posterior lobe of the right lung, but this animal had been lying in the shed for nearly twenty-four hours before death, and the pneumonia was undoubtedly a complication and not the primary disease.

No evidences of cholera could be found, and the case was pronounced an acute inflammation of the stomach and bowels due to improper feeding. Change in the rations was recommended. The hogs were allowed range of a small pasture, and in the course of a week the herd was back in good condition, no more animals being lost.

Another farmer in the same locality was not so lucky. He, too, had been feeding his hogs on a forced diet of corn, feeding the corn dry. The animals first developed slight symptoms of intestinal disturbance from which they partially recovered. He had a hog buyer from town come out to look them over, with the purpose of selling of the herd before any more got sick. The price offered was not satisfactory, and so he decided to hold them a few days to await developments. Some change was made in the method of feeding, and the animals improved and appeared to be in good condition again. About ten days later he found two animals dead in the pens. That same evening there was another dead hog. He called up the city buyer and made arrangements to ship the animals the next day. In the morning there were five more dead, and three more died in the car on the way to market. At the packing house, where these animals were slaughtered, over 50 per cent. of the herd were found to be suffering with cholera.

In this case the animals were in a weakened condition from irregularity of feeding, and when the buyer came to visit the farm and came into the hog lots he undoubtedly carried with him cholera

infection from some other diseased herd, and the result was the planting of the seeds of disease. With a lowered vitality already present, the animals proved easy victims for the cholera germs, and, while they improved for a few days when the method of feeding was changed, the damage had already been done and a severe type of acute cholera developed.

There are two excellent lessons to be learned from the experience of this man. One is that animals must be fed with due regard to a balanced ration, as otherwise digestive disturbances are bound to develop which will open the way for cholera.

The second lesson to be derived from this man's costly experience is never to allow butchers, drovers, buyers, or any one who is in the habit of visiting other farms to enter your pens. These men are continuously spreading disease germs to healthy herds, and you must learn to appreciate the danger of allowing anyone to mingle with your hogs who has recently come from any disease-infected farm. This applies to yourself and your farm employees as well. You should remain away from cholera-infected farms, and, if for any reason you do visit such premises, thoroughly wash your shoes or boots in some disinfecting solution before returning to your own farm.

In the Southern States large amounts of cotton-seed meal are fed to animals, and especially to hogs. This forms a quite serviceable article of diet, but here, too, as in the case of corn, the danger exists of producing digestive disturbances where cotton-seed meal forms an exclusive article of diet, and whenever you produce indigestion, diarrhea, or constipation you are in great danger of an outbreak of cholera. This is, of course, especially true if there be an outbreak of cholera in the immediate neighborhood. With respect to cotton-seed meal, it might be said that it produces an unnatural fat, which is of an oily character and does not chill out well in the coolers.

Another practice in respect to feeding that is especially dangerous is the use of the common swill barrel. These swill barrels are very common on the small farms throughout central Illinois. In this barrel sour milk, kitchen refuse, together with shelled corn, ground feed, etc., are all mixed together, and allowed to sour, ferment, and putrefy. These barrels are frequently never thoroughly

cleaned out from one end of the month to another, and during hot weather become a foul-smelling breeding place for flies, and a nuisance to all who have to come in contact with them.

The contents of this barrel are dipped out with an equally dirty bucket at feeding time, and fed to the animals in long wide troughs, in which the animal is able to get his feet as well as his nose. As a result, this food, which is already unspeakably filthy, is further contaminated by admixture with manure and dirt from the feet of the animal. You cannot expect man or beast to remain well on such food as this. It is utterly impossible; and while the hog, through long years of abuse, has developed a marked resistance to disease, there is a limit even to what a hog can stand, and large numbers of them perish every year as a result of such insanitary feeding conditions as those just described. This is especially the case with young pigs, who develop scours, thumps, and other similar diseases and die in a few days. The older animals have gotten more used to such feeding conditions, and may be able to weather through if cholera does not make its appearance. If it does, these herds are among the first to suffer, and the disease usually sweeps the hog lot clean before it ends its course. Animals with resistance so lowered by this kind of feeding cannot put up a fight against disease and filth at the same time, and the result is a victory for disease, death for the animal, and financial loss for the farmer, who is usually ready to blame his luck.

I know of a large feeder in western Indiana who has not had cholera on his premises for the past fifteen years, although the disease is all around him every year. His neighbors attribute it to his luck, saying that he is the luckiest man they have ever seen. It is not a matter of luck at all, however, as I became firmly convinced after a careful examination of his methods. His animals are allowed plenty of range space in which to exercise. They are not crowded together in filthy feed lots, where they are forced to eat their own discharges with their food. They have light, airy sleeping quarters, so arranged that overcrowding is impossible. They are fed with a well-balanced ration, which is always given to them clean and on clean feeding floors, or properly constructed troughs, so constructed that the hog can get his nose into the trough, but not his feet. Every precaution is taken to prevent infection

being carried to the pens by outsiders, and no new hogs are added to the herd without first being placed in separate pens for a period of thirty days and observed for any evidences of disease.

This is not a matter of luck at all, but is simply an exercise of that continuous vigilance which is absolutely essential to keep the herd in a healthy condition.

With respect to feed- and watering-troughs I would like to say a word of commendation for the feed-troughs which are so constructed as to make it impossible for the hog to get his feet into the trough. Dirt enough is carried into the food by the snout, but when we add to this that which is carried by the feet we are adding a lot of filth and disease-breeding material that cannot react otherwise than harmfully on the health of the herd.

Sunlight and Air.—These are two things that are often entirely overlooked in preparing sleeping quarters for hogs. There is no other single agent that is so effective against germs of any disease as bright sunlight. It will destroy the most resistant germs, such as tuberculosis, pneumonia, and the hog-cholera virus. Pens that are dark and damp are always disease breeders. Make your pens so that the sun gets a good opportunity to shine in on them for at least one or two hours each day. This will do more to prevent cholera and many other diseases than all the chemical disinfectants you can haul home. The hog especially requires plenty of light and fresh air if he is to get along properly.

Normally the temperature of the hog is much higher than that of other animals, and this means that he must have a greater amount of air in order to keep up this normal temperature. The hog requires more cubic feet of air space than does either the horse or ox. How sadly, indeed, this fact is overlooked in the construction of many hog houses and hog sleeping quarters.

I have often seen throughout Illinois, Indiana, and Iowa farmers who at threshing time would construct a framework of posts and old boards, which would be covered over with straw and used as a sleeping pen for the hogs. Many of these are constructed around threshing time, and the stack of straw placed right over this frame, so that the straw stack is on all sides, with only a small opening through which the animals enter.

At first glance these might look like ideal quarters for the

hogs in winter. They are shut off from wind and storm and should be warm at all times, regardless of how stormy or cold the day may be. This is very true; but, on the other hand, these sleeping quarters have absolutely no ventilation and they are always dark and filled with foul air. The rays of the sun never penetrate them, and hence they become a breeding place for germs. Hogs gather in these overheated quarters, and huddle together and become themselves overheated from the heat of their own bodies and lack of fresh air. In the morning they come out steaming, and are chilled through by the first blast of cold air, just like a hot-house rose. The result is that they are very readily attacked by bronchitis, pneumonia, and other diseases of the respiratory tract, and either die from pneumonia or are so lowered in vital resistance that they very readily develop the dread disease cholera if the infection is in any way introduced into the pens.

Associated with this poor housing there is usually irregular feeding and overfeeding with grains, especially corn. The inevitable result is disease of stomach and bowels as well as bronchial irritation, and the animal is thus prepared, as if by special intention, for invasion of cholera. These animals usually have a chronic cough all through the winter, and usually one or more of them fail to thrive and become runty before the coming of spring.

About two years ago I had occasion to observe a herd of this kind in northern Illinois. A hog house along the lines just mentioned had been constructed during the summer by making a framework of timbers, and allowing the straw stack to cover this at threshing time. The farmer had a herd of about 50 fine appearing Poland-China animals. These animals at night crowded into this pen or shed, which was about 20 feet long, 10 feet wide, and 5 feet high. They had developed a chronic cough, and a number of them were not doing well. The owner began to fear that they were developing cholera.

As none of the animals had died, and none of them seemed in a very dangerous condition, none were slaughtered for postmortem examination, but a change of quarters was recommended. The animals were removed to a larger, airy barn, where they could have plenty of air space, sunlight, and ventilation. Very little medica-

tion was ordered, and within two weeks all symptoms of coughing had disappeared.

Even more undesirable is the practice, so commonly seen, of allowing the animals to burrow under a rotten straw stack or manure pile at night. Here they get covered with an overheated, rotting manure, are entirely shut off from light and air, and frequently crowd in one on top of the other. The result is that they cannot fail to become overheated, and come out in the morning in such a condition that they are chilled through in a few minutes, and quickly bolt their food and hasten back into these unnatural and unhealthy quarters. Cough and pneumonia very frequently develop, and many animals die during the winter from simple suffocation or smothering.

One instance of this nature I had occasion to see in northwestern Indiana a few years ago. The hogs, about 40 in number, slept at night around an old straw pile which had been left to rot into manure, and which was water soaked and going through a fermentation process. The animals had burrowed holes and galleries under the stack, and there they crawled in at night to sleep. One or two of the animals first showed signs of coughing, and soon the entire herd was coughing. Finally one morning two animals were reported missing at feeding time, and when search was made they were found dead beneath the stack. The farmer at once suspected that his herd had cholera, and called the local veterinarian. Postmortem examination of the two dead animals showed absolutely no signs of cholera, but every evidence of death due to pneumonia in one carcass and undoubted evidence of death from simple smothering in the other.

The animals were removed to another lot, and suitable sleeping quarters provided for them, where they would have plenty of light and air, and where overcrowding would be impossible. As a result of this change the cough rapidly disappeared and no more animals were lost.

On a neighboring farm a similar form of hog shed to the ones described in the preceding pages had been constructed during the summer; that is, a framework of posts had been made and the straw pile placed upon this framework. As in the other cases described, the amount of space was entirely too small for the

number of hogs, and there was absolutely no provision made for ventilation or entrance of fresh air and sunlight.

These animals, too, about midwinter developed a chronic cough, which passed unnoticed for several weeks. Gradually, they began to be noticeably off feed, several developed a diarrhea, and, finally, refused to come out at all at feeding time. One of the animals rapidly became worse and died.

Postmortem examination in this case revealed swollen, enlarged lymphatic glands, which were almost black in color from being filled with blood. The lymph-glands in the ruffle fat were swollen and full of blood, and when the bowels were opened they were found to be almost one mass of large button-like, elevated ulcers. The ileocecal valve was covered by one large ulcer which extended over the entire surface of the valve. The large bowel was also freely sprinkled with ulcers. The kidneys were but little swollen, but showed a liberal sprinkling with dark red spots. In the thoracic cavity there was considerable evidence of a commencing inflammation of the lungs and a few blood-red spots on the surface of the lungs.

Further investigation revealed the fact that this farmer had had hogs die with cholera in these same lots the previous winter. Some of the infective virus was apparently still present, and this animal had died from a chronic form of cholera. The animals were changed to different quarters and fed with a patent medicine hog-cholera remedy for several weeks. As most of the animals were old sows, the disease did not get much of a foothold. Two more animals died and a number of the sows slunked their pigs. This outbreak was unquestionably brought about simply by the lowered resistance of the animals, due to insanitary sleeping quarters and overcrowding. The hog-cholera germs present were not in an active state, and hence the attack developed was of the mild type. Under proper conditions of fresh air and sunlight, with proper food, the disease would not have been able to get a new start at all.

As to the efficiency of the patent medicine hog-cholera remedy, it probably had little or nothing to do with checking the outbreak, although the farmer was thoroughly convinced that it was this remedy which did the work. The real cause for the quick ending

of the outbreak was the change to proper quarters and change in method and nature of feeding.

Disposal of Dead Animals.—In the prevention of hog-cholera there is always a great amount of trouble experienced in securing proper disposal of dead animals. The stock raiser does not seem to see the vast importance of this in the prevention of cholera. If you are going to keep your herd free from cholera you must absolutely understand the dangers which attend the common practice of allowing dead animal carcasses to lie exposed in your feed lots to be eaten by the hogs, and at the same time to attract to your farm buzzards from hundreds of miles around, bringing with them the seeds of infection which are sown on your premises, and you later reap the harvest in the form of a severe outbreak of hog-cholera. This may happen when there is no cholera for miles around, and you are at a loss to explain why your herd should have developed cholera, while your neighbors' herds, kept under apparently the same conditions, are free from the disease. Only too often it is looked upon as a matter of luck, and you are likely to arrive at the conclusion that luck is against you in the matter of raising hogs, and you decide to go out of the hog-raising business. This same line of thought has led many farmers to entirely abandon raising of swine, and in the Central West, where a few years ago it was almost impossible to find a farm without a large herd of hogs, to-day many farmers raise no hogs at all, and a great many others only such as they think will be needed for their own winter meat-supply.

Unfortunately for himself and his owner the hog is a meat-eating animal when meat is offered him, and will readily devour the carcass of one of his own kind or that of any other dead animal. This is such a convenient way to get rid of dead animal carcasses that many of us, who are inclined to think it a little too much effort to dig a hole and bury the carcass or make a fire and burn it, simply haul the dead animal into the feed lot and allow the hogs to do the work that properly belongs to us.

Now, in the case of dead hogs, this is altogether an inexcusable method. It does not take much reasoning for anyone to see that if the animals have died of cholera, their flesh will transmit the disease to any other healthy animal that eats this infected

flesh. When we discussed the virus of cholera we found that this disease-producing material is found throughout the entire carcass. It is found in enormous quantities in the blood, in the muscles, in the liver, in the bowels, in the lungs, and, in fact, in every part of the body. To feed to healthy animals the dead bodies of hogs which have died of cholera is to sign their death-warrant. They will contract the disease as sure as the sun rises, and the type of disease so produced is usually of the most dangerous and acute type.

Some few years ago, while visiting in northern Wisconsin, a strange hog came upon the premises one afternoon and was evidently at that time in a very sick condition. During the night the animal died. In the morning the hired man was told to hitch up the team and drag the carcass over into the feed lot, and allow the hogs to devour the carcass. This was done, and the large herd of hogs in the feed lot made short work of the dead animal, it having all disappeared within a few hours.

About ten days later several of the younger animals were noticed to be off feed. In a short time they had lost all appetite, were remaining hid in the litter of the hog shed in the mornings, developed a characteristic cough and a profuse foul, dark-colored diarrhea. Within another week they began to die rapidly. Post-mortem examination of some of the dead animals revealed typical lesions of hog-cholera.

In this case the disease was unquestionably transmitted to this healthy herd from the dead carcass of the strange animal that had died on the premises. The younger animals, being the more easily attacked, were the first to show the evidences of the disease, and quickly died from the effects.

Another case that came under my notice a few months ago was that of a feeder in central Illinois. This man had a large herd of hogs which were running after cattle in his feed lots and pastures. He had three other fat hogs that were kept in a small pen near the house, where they were slopped with kitchen refuse as well as other swill, and were being fattened for slaughter for home meat-supply. One of these animals gradually developed an attack of illness with diarrhea, loss of appetite, loss of weight, and cough. The animal lived for several days, but finally died. The carcass

far as we know, that will take this disease. The virus which produces cholera is unable to gain a foothold in the body of any other of the common animals found on the farm, and so we never find cholera attacking the horse, the ox, the sheep, or man. There is a great deal of resemblance between cholera in swine and typhoid fever in man. Both diseases are marked by the occurrence of ulcerations in the bowel, diarrhea, and profound prostration, but the two diseases are not the same, and neither can be transmitted from man to the hog, nor from the hog to man.

Accordingly, it is often hard to get the stock-owner to see wherein there can be any danger in allowing his hogs to eat the carcass of a dead horse or a dead cow. They will willingly do so, they seem to enjoy the meal, and it certainly saves him a lot of extra work, and especially is a convenience if the animal happens to die during the busy season. These animals do not have cholera, and so cannot cause cholera to break out in the hogs, so what danger can there be in allowing the hogs to have the feast they will enjoy so well?

There are a number of very good reasons why you should never allow a dead animal carcass of this kind to be disposed of in this manner. While it is all very true that the other farm animals do not have cholera, and cannot directly produce cholera in hogs, there are numerous indirect ways in which they may, and often do, lead to the development of cholera in the animals which are allowed to eat their dead bodies.

In the first place, in connection with cattle, a large percentage of the dairy cows on our farms are affected with tuberculosis, and it is a pretty safe estimate to say that nearly half of the cows which die on the farm either die from tuberculosis or have effects of this disease in their body. Now this disease is directly transferable from cattle to hogs, and if the hogs are allowed to eat the carcass of an animal that has died from tuberculosis they are almost certain to themselves develop the disease.

In nearly every dead body of any animal that may die on the farm there are present some disease germs which caused the death of the animal. It may be an infected wound, it may be an infected uterus after calving, or what not. In each and every case there is some germ present which caused the death of the animal. Now

these disease-producing germs may not be able to directly reproduce the same disease in the hogs which eat the dead body of the animal in which they have produced death, but they are capable of setting up stomach and bowel disturbances which will so lower the resistance of the animals that they very readily fall victims to an attack of cholera if they become exposed in any manner to the germs of the disease.

Some two or three years ago I met with an outbreak of cholera which was brought about in the following manner: The feeder was one of the large stockmen of the Central West. He had a large herd of cattle, and following these cattle in the pens he had a drove of several hundred young shoats, averaging, perhaps, 100 pounds each.

Early in the winter he began to feed silage to the cattle from a new silo which had been put up during the summer. For some reason or other the silage had undergone a fermentative change, and had developed a ptomain or poison of some sort which proved extremely poisonous to the cattle. They began to show signs of poisoning, indigestion, diarrhea, high temperature, and one or two of them died in the course of a few days. These dead cattle were left lying where they died in the pens and were soon cleaned up by the greedy hogs.

Several of the hogs developed an attack of scours after eating these carcasses, but they soon recovered, and were apparently as well as ever. About a week later three more of the cattle were found to be sick, and as there was a local veterinary surgeon vaccinating a herd of hogs about a mile and a half distant he was called up and requested to stop at the farm on his way back to town.

This he did, and went out into the feed lots to examine the sick cattle, having come directly from the farm where he had done the vaccinating. The hogs on this farm had already developed cholera several had died, and a large number had a high temperature. He soon determined the cause of the trouble in the cattle, and recommended that the feeding of the silage be discontinued. This was done, and the disease affecting the cattle quickly disappeared.

About two weeks later, however, several of the hogs were noticed to be ailing, and in a few days were dying at a rapid rate

The veterinarian was again called, and, on postmortem examination, found typical evidences of acute cholera.

Now this case presents a number of very interesting and instructive lessons. In the first place, it shows the dangers attending the feeding of silage which is not properly put up, or which is placed in improperly constructed silos. The silo, properly handled, is one of the greatest improvements of recent years in the winter feeding of live stock, but it also holds great possibilities for harm in the hands of the inexperienced or careless, as this outbreak of forage poisoning demonstrates.

Now, the feeding of the dead animal bodies which had died from forage poisoning did not produce death in the hogs which had eaten them, but they did produce an attack of scours and inflammation of the bowels which prepared the way for the introduction of the cholera infection, which was undoubtedly carried on the boots of the veterinary surgeon coming directly from a cholera-infected farm. In this manner but a small amount of disease-producing material was brought in, and under ordinary conditions probably would not have been sufficient to have produced disease. The animals, however, already had their resisting powers reduced by the stomach and bowel trouble, and were in the proper condition to get sick from even a small dose of the virus.

Too much care cannot be exercised in keeping away from your animals any form of food which will produce inflammation of the stomach or bowels, and thus open the door for the entrance of cholera.

Another point not to be overlooked in this outbreak is the danger of coming directly from an infected cholera farm to another farm where hogs are kept without thoroughly washing off the shoes or boots to remove all disease-bearing manure and mud, which is bound to collect when you pass through a hog lot containing cholera animals. This veterinarian unconsciously was the means of introducing cholera on this farm. The hog-cholera virus is no respecter of persons, and, if you are a veterinarian, you must remember that the cholera virus can be carried on your shoes just as easily as on the shoes of a stable-boy, and you owe it to your patrons to take every precaution to see that your shoes or boots are thoroughly washed and disinfected before leaving any farm

where you are called to vaccinate or otherwise treat cholera animals.

Early last spring I remember seeing a case of cholera develop in a herd of healthy hogs, which was brought about in the following manner: The owner had a cow which died from a severe inflammation of the womb following calving. This disease was of a most poisonous nature, and finally produced death from a generalized blood-poisoning. The carcass was hauled over into the hog lot and the animals allowed to feast upon the dead body.

There was considerable cholera in the neighborhood at the time, but so far the hogs on this farm had remained entirely free from the disease. About two days after they had eaten the carcass of the dead cow nearly the entire herd, and especially the younger animals, developed a severe diarrhea and inflammation of the stomach and bowels. So severe was this attack that several of the young pigs died. Postmortem was made, as it was feared an outbreak of cholera had developed. No signs of cholera were found, however, and in a few days the animals began to get well again.

In the course of another week several were noticed to be sick again, and postmortem of one which died a few days after this second attack showed the regular picture of cholera with blood-colored spots in lymph-glands, bowels, lungs, kidneys, and skin. Here, again, the eating of meat containing disease-producing germs had resulted in a severe inflammation of the bowels from which a number of the pigs died. Young pigs are not very resistant to infections of the stomach and bowels, and are readily carried away by scours and other diseases of the digestive tract.

The older animals were harder to make sick, and were able to weather the storm of the first infection, but it left them in such a weakened condition that they were easy victims for cholera infection, which in some manner had been brought to the feed lot from nearby farms on which cholera was present.

While the direct dangers from the feeding of dead animal carcasses is very great, as already pointed out and illustrated by the above examples, there is another indirect danger which is even more to be feared than those just mentioned.

This added danger lies in the drawing power which these ex-

posed dead animal bodies have for buzzards and crows as well as other birds of prey. The buzzard, especially, is common in the United States, and during cholera outbreaks in the Central West I have seen flocks of them arising from cholera-infected farms which would almost hide the sun from view, so large were their numbers.

The buzzard, especially able to smell dead carcasses of any kind, will come for miles and miles to perform his duties as scavenger. The bird is provided with large and powerful claws, by means of which he is enabled to tear the flesh of the animal from its bony attachments, and it is by means of these same claws that he is enabled to carry disease germs from one farm to another.

If you leave a dead animal carcass exposed in your feed lots or pastures for a few days you will soon find that there have gathered a large flock of buzzards, which have in many cases come directly from some district, perhaps a hundred miles away, where there is an outbreak of hog-cholera. On their claws they carry the infected blood and pieces of the diseased flesh of the last dead hog carcass upon which they feasted. These they scatter about and mix with the flesh from the dead horse or cow which lies in your pasture. In this way the flesh from these carcasses which your hogs may eat is thoroughly seasoned with hog-cholera virus, and it is not long to wait for developments in the form of a severe outbreak of cholera, which will provide further feed for the hungry buzzard.

I observed an outbreak of cholera over in McDonough County, Illinois, a few years ago which was undoubtedly brought about in this manner. There had been for several weeks a severe outbreak of cholera raging in the part of the state just south of this county. No cholera had as yet appeared, however, in the locality which I have in mind, and there were no cholera herds, so far as known, for nearly twenty miles.

One of the stockmen in this district had a herd of cows break into a cane patch one Sunday afternoon, and before he could get them out seven of the herd were so badly poisoned that they died before a veterinarian could reach them. These dead animals were left exposed in the field, as it was a very busy season of the year, and the hogs on the farm were allowed to feed upon them. Seven carcasses coming all in one bunch was a little more than the

hogs could conveniently clean up on short notice, and, as a result, within a few hours buzzards began to circle in the air over the pasture, and it was not long before a good-sized flock of these birds had been attracted from the cholera farms further southward. The buzzards remained in the pasture and a nearby woods for several days, aiding in disposing of the feast.

Within two weeks the hogs on this farm and also on a couple of adjoining farms, which were circled over by the buzzards in going to and from the woods, showed signs of disease, and within another week a full-fledged outbreak of hog-cholera was in full swing in this district. The disease had unquestionably been brought up from the cholera district many miles further south by the hungry buzzards. Proper disposal of these carcasses by burning would have prevented this outbreak and saved a loss of several thousand dollars to the community. It would certainly have been a paying investment for the neighbors of this farmer if they had all combined and aided in the proper burning of the dead carcasses.

In western Missouri I obtained the history of a severe outbreak of cholera which swept over an entire township, which was spread largely by leaving the dead animals exposed to attack by buzzards. The feeder upon whose farm this outbreak got its start brought in a carload of hogs from Arkansas and placed them on his feed lots, which had been cholera infected the previous summer. Within a month after these hogs had been placed in the lots they began to die. Symptoms during life and postmortem findings pointed unquestionably to cholera, the germs of which had evidently lived through the winter and remained in the feed lots sufficiently active to again attack healthy animals.

At about the same time that the animals began to die there was an outbreak of typhoid fever in this farmer's family, and the dead animals were, of necessity, neglected. The care of the sick at the house, together with such of the farm work as could be attended to, took all the man's time. He simply left the hogs to take care of themselves and trusted to luck.

As a result, the pastures were soon filled with decomposing and rotting dead hogs. As the pasture was located in a field through which a running stream found its way, several of the dead animals were left to rot in the stream, and were carried down its course by

frequent rains. Large numbers of buzzards were attracted by the chance for a feast, and in a few days the heavens were black with large hordes of these disease-carrying birds.

It was only a short time until the outbreak was widespread over the entire community. Dozens of farms were infected, and, coming as it did in the midst of the most busy time of the year, dead animals were everywhere neglected and left to decompose in the fields, or thrown into shallow trenches and partially buried. Such conditions as these are just where cholera thrives, and the outbreak spread like a prairie fire before a breeze. Herd after herd was destroyed, and when I visited this section of the state several months later there was scarcely a hog to be found. Many farms had not a single hog, and the owners declared their intention of remaining out of the hog business until some means had been found of preventing such enormous losses.

This outbreak again brings before us many important object-lessons in connection with cholera. First, it again illustrates the fact that the hog-cholera virus is capable of living in infected pens through the winter months, and will attack new animals which may be placed in the pens the following spring. This is especially the case where no proper effort is made to thoroughly clean up and disinfect the pens. No such effort had been made in this instance. Had these pens been thoroughly cleaned, all waste burned, the surface of the pens thoroughly sprinkled with chlorid of lime or solution of cresol, and then exposed to the action of sun and frost, there might have been a different story to tell. It takes actual work, and lots of it, to rid an infected hog lot of cholera virus, and unless we are willing to put forth the necessary effort to destroy the disease germs on our premises we will have repeated losses just as frequently as we put new, healthy animals back in the infected feed lots.

This outbreak also very plainly shows the attractive power which exposed dead animal carcasses have for buzzards. In this outbreak it was only a few hours after the first animsls were left exposed in the fields until a flock of buzzards had begun to gather, and in a remarkably short time they were present in large numbers. These birds, in circling over other farms adjoining the original seat of the outbreak, quickly scattered infectious material where it

came in contact with healthy animals, and thus sowed the seed for further development and spread of the disease.

Had this man or his neighbors taken prompt action at the start of the outbreak, and burned all dead carcasses as rapidly as they were found, there would have been no attraction for buzzards, no spreading of the outbreak, and the disease could most likely have been held on this one farm. It should be made the lawful duty of every man to promptly burn all dead animals on his premises, and where, for any reason, it is impossible for him to do so, it should be the duty of the township constable, the deputy state veterinarian, or other proper official to have this work done at once.

In the spreading of this outbreak there was another important factor which must not be overlooked. This was the running stream which crossed through the pasture. The waters of this stream were made impure both by drainage from the infected pastures along its banks and also by the actual presence in its bed of large numbers of rotting dead bodies. The diseased materials which in this manner found their way into the waters of the stream were carried along into other feed lots, and unquestionably proved important aids in rapidly spreading the disease. This was fully borne out by investigations made among farmers along the course of this stream. In almost every case the disease had visited their premises and wiped out herd after herd, the death-dealing power of this outbreak apparently being of the most active and fatal character.

Another point worthy of deep thought concerning this outbreak is the lasting results on the hog-raising industry in the disease-swept section. Not only was there an enormous loss of animals from the disease during the course of the outbreak, but there was also the loss of large numbers of valuable brood animals, and, as a result, the following year finds this section of the country practically bare of hogs. Not only this, but the hog raisers of this district are inclined to withdraw entirely from the hog business, as they have suffered such severe losses they are not inclined to risk another outbreak similar to the one through which they have just passed. It is just this sort of feeling left after a cholera outbreak which explains the decline in the hog-raising industry in the past ten

years, and the only way in which the breeding of hogs can be encouraged and brought up to its former firm footing is by a united effort on the part of everyone connected directly or indirectly with hog raising for the driving out of the disease. We apparently have in our hands at this time, through the efforts of the United States Bureau of Animal Industry and numerous state workers, an agency which is capable of accomplishing this result. All it requires now is that proper use be made of its power to accomplish the desired results. A great deal has already been done on a small scale, but the field is yet practically unexplored, and it will require years of steady hard work to drive this disease out of the hog belt. The reward in sight, however, is well worth the effort, and every true citizen should put his shoulder to the wheel and keep it moving.

Proper Methods of Disposal.—When it comes to a discussion of proper methods of disposal of dead animal carcasses, there are but two methods of disposal that are worth talking about, and one of these is so much better than the other that there remains truly but one method worthy of consideration. The two methods referred to are *deep burial* and *burning*. Of these two, *burning* is so much better than burial, both from the standpoint of labor involved and actual results, that burial should be mentioned only to be condemned.

In many cholera outbreaks we have the development of a class of traders who travel about the country with an old lumber wagon and gather up the dead animals, either paying a small price for them or getting them for nothing simply for hauling them away. These scavengers are the cause of spreading more cholera than a united effort could wipe out in a season. They travel about in old, filthy wagons, and dressed, as becomes their trade, in clothing that is rotten with filth and disease germs. Everywhere they go they carry with them the infectious germs of cholera, and scatter it along the roads as they travel about from farm to farm.

During an outbreak of cholera three years ago in western Iowa there were a number of these men traveling about the cholera-infected district, looking for dead animals that they might be able to gather up. On a certain farm where cholera had not as yet made its appearance these men drove up along in the middle

of the afternoon, and, as a shower was just coming up, they drove in under the roof of a wagon shed to seek shelter until after the storm had passed.

As these men were seeing a great deal of cholera every day, they were looked upon as being able to diagnose the disease very readily when present. The farmer took one of them over into his feed lot to look at his herd of hogs and see if they were showing any evidences of cholera. After a close inspection of the herd the traveler decided that they were in perfect health.

Several of these hogs had the run of the barn lot in which the shed was located which sheltered the team and wagon during the shower. They were, on this account, in a position to come in contact with any infected manure, mud, or litter which might be washed off of the wagon wheels. Two weeks after the visit of the dead wagon to this farm the hogs began to die, and after that the wagon made regular calls there every day to collect the fruits resulting from the seeds of infection sown there a few days before.

This case again illustrates two important dangers which must be avoided if you wish to prevent the entrance of cholera onto your farm. In the first place, these scavengers should not be allowed to go about the country scattering infection everywhere they go, and especially you should never allow one of these dead wagons to come inside your gate unless you already have cholera on the premises.

Second, it shows the danger of taking any stranger into your feed lots, and especially is this danger a most pronounced one if the man comes from other hog lots which are the seat of cholera outbreaks. Cholera-infected pens contain the virus of the disease in the manure, the mud, the litter, and, in fact, on almost everything with which the shoes may come in contact, and more or less of this infectious material is bound to cling to the shoes and be carried from this farm to the next place that the trader visits. It only takes a very small amount of this virus-containing mud to scatter the disease in another feed lot and infect one or two animals there. When they develop the disease their infectious discharges very quickly scatter hog-cholera among the balance of the herd.

Make it an invariable rule to keep all strangers out of your

feed lots, and it is even better still to make it a rule to keep everyone out of your feed lots, whether they be strangers or not.

Another outbreak of cholera which was directly traceable to one of these scavenger wagons was reported from southeastern Minnesota. During an outbreak of cholera in that section a few years ago these dead wagons became quite numerous, and, as the outbreak was a very severe one, they found the business a most profitable one.

One farmer with a large herd of hogs turned them out of the regular feed lots into a meadow pasture which bordered along the public roadway. So far these animals had passed through the outbreak without showing any sign of disease. Cholera was raging, however, all around the farm, and several of these dead wagons were passing by the roadway every day.

When turned into the new field the hogs at once started out to explore the size of their new territory, and it was not long until some of the smaller pigs crawled through the hedge fence that separated the pasture from the public highway and were out on the roadside. Naturally, they came in contact with infected litter and manure which had fallen out of these scavenger wagons in passing by.

About the end of the second week after being turned into the meadow pasture the pigs began to show signs of sickness, and in a few days more the old hogs developed a typical outbreak of cholera. The source of the infection here was almost certainly from the infectious material scattered along the public highway by these dead wagons, and which had been taken up by the young pigs.

This case also illustrates the enormous possibilities for harm that arise from permitting this practice of gathering up dead hogs in these tumble-down wagons, and hauling them along the public highway to scatter infection broadcast over the community through which they may pass.

Another important lesson to be learned from this man's experience is the danger of allowing hogs to feed in a pasture which borders on a public highway. Public roads are constantly being traveled by wagons carrying hogs to and from markets, and there is always the danger that some of these animals are suffering from

cholera. It is not infrequently the practice to drive hogs to shipping points, and very frequently these herds are hustled off to market because they are showing evidences of cholera. We also have these scavenger wagons continuously passing up and down the highway during cholera outbreaks, and, in addition, we have the rigs of butchers, commission buyers, and others who are constantly in and out of hog lots, loading pens, infected chutes, cars, etc., and are thus constant carriers of cholera infection.

Hogs are always trying to enlarge the size of their range, and when pastured along a public highway are liable at any time to discover a weak point in the fence through which they gain entrance to the roadway and, at the same time, to the cholera infection. This was the cause for the outbreak in the case just described, and it is a very likely occurrence at any time when hogs are allowed to run in a field immediately bordering upon a public roadway.

Another danger in these pastures which border upon the public highways is that frequently hog buyers will be driving along the roadway and stop to look over the herd before driving up to the house to try and make a purchase. It is not at all unusual if they get out, climb over the fence, and go over into the field for the purpose of making a close inspection of the herd. They do this simply to save time and to get a little advance idea of the condition of the animals.

I happen to know of one herd which was infected in just this manner. The hog lot was located about a half-mile from the house in a small pasture which bordered along the public roadway. There was cholera in a nearby township, and one of the hog buyers from the closest village had been out in the country buying hogs. He had visited the infected territory and had been in a great many of the infected lots, culling out the animals that appeared well enough to make the market without dying on the way.

As he was driving past this hog lot he noticed the hogs inside the fence, stopped, and climbed over into the feed lot to have a look at them. He spent perhaps fifteen minutes among the animals, looking them over carefully for any evidences of disease. He then drove on back up to the house and went in to talk trade with the owner. It so happened that this farmer was not in the notion to sell and no trade was made.

Less than two weeks later three or four of the animals were noted to be off feed and scouring, with a black-colored, very nasty diarrhea. In less than a week there was a full-fledged outbreak of cholera in this herd, which nearly wiped out the entire drove.

Roadside pastures are also likely to infection in another manner. This is by the carrying of infected litter and dust from the roadway over into the hog pastures by wind. This danger, while relatively unimportant, is nevertheless well worth considering, and offers another good argument why hog pastures should never be located along a public roadway.

In the first-mentioned outbreak there is another interesting fact worthy of notice, that is, the ease with which the young pigs became infected. In these roadside pastures it is especially the pigs that are liable to go through small openings in the fences and get out upon the road. It is also the pigs which are most easily made sick by cholera infection and, therefore, the more likely to contract the disease.

Where any systematic effort is made to dispose properly of the dead cholera animals, burial is perhaps the most commonly resorted to in the hog-raising belt, although in the past five years farmers have come to realize the advantages of burning, and more animals are being burned every year.

Burial of cholera animals has a number of disadvantages, not the least of which is the fact that it is most disagreeably hard labor and takes a large amount of time. It is no child's play to go out and dig a pit 6 feet deep and 8 or 10 feet long on a hot summer day to bury animals which represent a dead loss. The tendency is bound to develop to let them accumulate for a few days and then make one job of it, and this is certain to result not only in allowing the dead bodies to remain exposed to the attack of buzzards, but it also causes the accumulation of such a big amount of work that a shallow trench is dug and the dead hogs rolled in and covered with a foot or so of loose earth. Such burial as this is about the next thing to leaving the carcasses exposed, as they are quickly dug up again by dogs, skunks, and other animals.

Burial, to be properly done, should place the animals at least

6 feet under the surface of the ground, and the dead body should be covered by at least a foot of quicklime before filling in with earth. Only in this way can burial be regarded as a proper method of disposing of dead cholera hogs, and even then it is not so good as burning, which is so much easier, so much quicker, and so much more effective in destroying germs that are capable of producing the disease in other healthy animals.

The germs of hog-cholera have the power to live for several months in moist earth, and especially so when they are also in contact with a decomposing animal carcass; so that if we bury the dead body of a hog dying from cholera we simply place the germs under conditions wherein they will live for months, and even for a year or more. When we add the foot of quicklime we are adding a substance which kills germs, and will, in large measure, at least destroy them as it comes in contact with them. I am firmly convinced, however, that there is no agent that will destroy germs like the heat of a burning fire, and this is the proper method for disposing of the carcass and the germs at one and the same time.

Evidences of the bad effects which follow burial of dead hog-cholera carcasses are not hard to find.

During the fall of 1900 we had a severe outbreak of hog-cholera in western Illinois, and one of the farms adjoining our own was the seat of a very severe outbreak. Here the dead animals were allowed to pile up through the week, and on Sunday a trench, perhaps 3 or 4 feet deep, was dug and the carcasses rolled therein and covered with earth. The outbreak ran the usual course, and practically swept the hog lots clear of living animals.

During the winter a number of brood sows were bought at public sale and brought home for the purpose of restocking the hog lots. Several strong litters of pigs were born during the early spring and thrived well until about the first of June, when the animals were turned back into the old feed lots and pastures. Here the pigs began to root about, and it was not long until they had begun to uncover the bones of the victims of the previous summer outbreak; also, it was not much longer until these pigs began to die, with symptoms which unmistakably were those of cholera.

Here we have an excellent example of the results which follow

improper burial of dead cholera hogs. These pigs thrived first class until they came in contact with the remains of these dead animal bodies. The disease-producing virus had been able to remain active even throughout the winter, when protected by a layer of earth and furnished with food in the form of the decomposing dead animal bodies.

Here, again, also we have an example of the extreme ease with which pigs are made sick by hog-cholera germs. Perhaps the older animals might have been resistant enough that the virus in its weakened state would not have been able to attack them, and, as a matter of actual fact, the sows did not get sick until nearly two weeks after the pigs began to die. They were most likely infected through the virus which was scattered over the lots through the discharges of the sick young pigs.

Another source of danger from the practice of burial of animals is illustrated by the following epidemic, which was scattered through a herd in western Indiana a few years ago:

Two farmers lived on opposite sides of the public highway, and each had a herd of hogs, neither of which were in pastures adjoining the road. Cholera broke out on one farm, and soon there were a number of animals dying each day. At first an attempt was made at deep burial, but, as the outbreak became more widely scattered through the herd and the number of dead each morning increased, the method of burial became more slack, and the usual shallow trench was dug and the animals covered with 1 or 2 feet of loose earth.

The farmer across the road had a large shepherd dog which was in the habit of ranging over the fields of both farms with equal freedom. He was not long in discovering the newly made graves, and, prompted by curiosity and the odor of fresh meat, he proceeded to explore. The result was that he returned home with a large hog bone, torn loose from one of the decomposing cholera carcasses. In returning home he dragged this up through the hog lots, and, after gnawing upon it awhile, buried it in a corner of the hog lot.

Several of the small pigs about the hog lot soon uncovered the bone and were not long in beginning to tear it apart. In this way they were brought into direct contact with the disease-producing

virus, just as certainly as if the dead carcasses had been hauled into the feed lot and left for them to feed upon.

Cholera made its appearance in the herd in about ten days, and, as in most outbreaks so carried, made its appearance first in the younger animals, but soon spread to the old sows, and within a month or six weeks had swept the lots bare of every living hog.

This man's experience goes to show a couple of interesting points in connection with the spreading of hog-cholera. In the first place, it shows again that burial is not a proper method of disposing of dead cholera carcasses, and especially so when the animals are not deeply buried. This case also illustrates the danger of having a dog about the premises that has the habit of wandering about the neighborhood and crossing from one feed lot to another, carrying with him infection and disease-producing material. A good dog is a valuable animal upon any farm, but a straying hound is a nuisance, and is very dangerous to the health of other animals, especially hogs, when there is an outbreak of cholera in the neighborhood.

Another outbreak of cholera which was widely spread through improper burial of cholera carcasses was seen in northeastern Nebraska. Here the outbreak started on a farm which was located rather high along a certain watershed. About 300 yards further down the slope there was located a small running stream, but the hogs were not running in the same pasture that the stream crossed through. When they began to die the dead animals were removed from the hog lot and taken out into this second pasture and buried at a good average distance under ground.

The spring was a rather wet one, and the seepage from the graves evidently was carried down the slope and entered the waters of the stream, which, accordingly, became infectious and disease producing. It was only a short time until further outbreaks occurred on farms located further down the course of the stream, and in a few weeks a widespread outbreak was in full play along the entire valley.

Here, again, we have an example of how cholera virus may be carried through surface drainage and seepage to contaminate streams with which the animals do not come in direct contact, and

thus prove the means of carrying the disease for miles along their course. While it is probable that a certain amount of the stream infection occurred from surface drainage from the infected feeding pens, yet it cannot be questioned that the danger was vastly added to by the seepage from the graves of the buried dead.

Again, it gives us an example of the danger which goes with any running stream which may pass through a pasture in which hogs are kept. You are never in a position to say when the waters of such a stream may become dangerous, and the only safe plan to follow is to absolutely keep hogs out of pastures which are crossed by these running streams.

With respect to burial of dead animal carcasses, it may also be added that many seemingly unimportant things may serve to bring the infection to the surface again. For instance, earth worms usually burrow in large numbers in freshly made graves, and they frequently bring with them to the surface portions of the infected carcass. Squirrels likewise are very frequently found burrowing in the soft earth of these burial places, and bring large amounts of the infected earth and remains of decomposing dead bodies to the surface. Moles, polecats, and other rodents also have these same dangerous habits. Any way you look at the buried carcass it is a source of danger, and this method of disposing of the dead, and especially of dead animals which have died of cholera, should be discontinued.

Remember that it is not only large animal carcasses left exposed to the attack of buzzards which result in fatal cholera outbreaks among hogs. Small animal bodies, and especially those of dead chickens, may often prove to be the necessary attraction for the buzzard, which is ever watchful for an opportunity to supply himself with a meal from some dead body.

I have often noted in the Central West that an outbreak of cholera among the chickens in a given district was followed within a few weeks by an outbreak of cholera among the hogs. In fact, so common is this occurrence, many farmers have become impressed with the fact that these diseases occur so often together, they believe there is a very close relationship between the two diseases, and some even think chicken-cholera causes hog-cholera.

On one occasion I am quite convinced that the disease among the chickens was the cause of the outbreak in the swine. Not that chicken-cholera and hog-cholera are the same by any means. The two diseases are entirely independent, and chicken-cholera is not by any means transmissible to swine, and neither is the disease of hogs transmissible to fowl. There was an outbreak of cholera among the chickens on a certain farm in central Iowa about the first of July, and the flock began to die in large numbers. Most anywhere you might go in the pastures you could find a large pullet or cockrel dead and decomposing. Those birds which died around the house were gathered up and thrown out in the center of a large stubble field, a short distance from the house. Here they were left to decompose and rot.

It was not long until there could be seen circling in the air the ever-alert buzzards, attracted from miles away by this opportunity for a feast. It was afterward found that the most likely source from which these buzzards came was a hog-cholera-infected farm nearly one hundred miles further north. In any event, they unquestionably brought with them the germs of cholera infection, for about two weeks after their arrival in the neighborhood hogs on several of the surrounding farms, as well as the cholera-infected premises, began to show signs of illness of a peculiar character. The diagnosis of this disease among the swine was not long in doubt. Deaths by the dozen, with typical postmortem findings of old-fashioned cholera, left no question as to the nature of the outbreak.

This outbreak illustrates how dangerous is the practice of leaving any dead carcass of any kind exposed where it may become the cause of attracting buzzards. The buzzard has no preference, and will be readily attracted by a dead carcass of any kind, be it chicken, horse, man, hog, sheep, cow, or what not.

This outbreak also goes to show how readily these birds can scatter cholera virus over a neighborhood, not only on the farm to which they are attracted, but also nearby farms over which they circle. It is a typical characteristic of the buzzards that they circle over wide areas, and in their flight they often loosen large fragments of disease-producing material from their claws, which, falling into a hog pasture, readily become the means of spreading

the disease to healthy animals. A flock of buzzards circling over your farm are as dangerous to your hogs as a fleet of bomb-laden airships would be hovering over a fleet of war-vessels in time of war. The bombs which these birds liberate from their claws, in the form of pieces of diseased dead meat, are just as deadly and death dealing to your herd of hogs as are the dynamite bombs which might be thrown down upon the decks of the battleship by the airmen in time of war.

As an example of the effects which follow a proper disposal of dead carcasses I would like to call attention to the following small outbreak of cholera in central Indiana a few years ago, which was effectually checked without getting off of the first farm on which it started.

The disease first made its appearance on a small farm of about eighty acres, located in the southeast quarter of the section. This farmer had about 60 head of hogs in all, and the disease was brought on the farm most probably through a boar which had been bought several weeks before. This boar had been through an outbreak of cholera, and while he had had the disease in a very severe form he had apparently entirely recovered.

As soon as this outbreak started the owner notified all his neighbors of the fact and advised them to keep away from his premises. The healthy hogs which were fit for the market were at once shipped. Those which remained rapidly contracted the disease, which, while at first mild, rapidly took on a most deadly form. At the end of three weeks only 3 animals were left alive on the premises.

Every dead animal was burned the same day on which it died, and the premises were sprayed with a germ-killing dip solution every morning. This man kept his neighbors away from his hog lots and he stayed away from theirs. Many of the owners on surrounding farms had their herds vaccinated, some using the simultaneous, others the single serum, treatment method.

Not a single buzzard was seen in the locality during the course of the outbreak, and the disease did not make its appearance on any farm outside of the one first infected.

This is an excellent example of what can be accomplished by proper regard to the laws of hygiene in handling an outbreak of

cholera. Every cholera-infected farm should be properly branded with a quarantine flag, and owners of swine warned to keep off the premises. Every dead carcass should immediately be disposed of by burning, and the premises thoroughly cleaned up and disinfected at the end of the outbreak. It is by such methods as these that doctors of human medicine are driving the pestilences and plagues of former centuries off the face of the earth, and it is by such methods as these that we must meet and cope with this dread disease of hogs, which is threatening to wipe out the hog-raising industry of the United States.

Strict methods of quarantine may mean a little inconvenience for a few weeks to the owners of infected farms, and may not appear to them to be justified, but it is an absolute duty that they owe to their neighbors, just as much as if one of the members of their family was suffering from small-pox, Asiatic cholera, or some other deadly catching disease. In the final summing up the little inconvenience suffered will more than be repaid by the general benefit not only to the farmer so unfortunate as to have his herd stricken, but to the general public as well.

The Turkey Buzzard.—When it comes to scattering cholera over a large district there is one agency that, with the help of carelessness in the matter of proper disposal of dead carcasses, can accomplish more harm in a few weeks than any other single agency. This is the common turkey buzzard.

The buzzards are widely distributed all over the hog-cholera belt, and are quickly attracted by any kind of dead animal which may be exposed where they can conveniently attack it. As has been already stated in previous pages, the buzzard has a very marked power of locating dead animal carcasses, and is provided with a powerful pair of wings. These two faculties enable him to travel frequently for hundreds of miles in order to reach a new feeding ground.

In many states the buzzard has been protected by law for many years under the wrong impression that he was of great benefit to the public in aiding in the disposition of dead refuse. That this law is a wise one is hardly in harmony with our present knowledge of the heavy losses that are traceable to the buzzard as the source of spreading the disease. Some states, notably Tennessee, have

already repealed the laws affording protection to buzzards, and others will soon follow suit when the great possibilities for harm which this bird possesses are more clearly understood.

In a way it seems rather unfair to censure the buzzard for something which he is not directly to blame for. If everyone would properly dispose of their dead animal carcasses at once by proper burning, or even by deep burial, there would be nothing to draw the buzzard to the neighborhood, and he would have no opportunity for spreading disease over large numbers of widely separated farms, as is the case under present careless conditions.

Too great stress cannot be laid upon the fact that it is not necessary for you to leave dead hogs exposed to buzzards to have the bird bring cholera upon your farm. A dead cow, a dead sheep, a dead horse, or a dead dog or chicken will draw the buzzard just as quickly as will a dead hog, and there is always a strong chance that the buzzards which come on your farms have been attracted from a cholera district possibly several miles away.

Illustrations have already been cited of how cholera is carried in this way, but so important is this method of spreading the disease, and so little is its full danger appreciated, that a few more instances may be profitably given.

A certain stockman in central Illinois had a large herd of sheep and a drove of hogs running in a woods pasture during the past summer. He visited the herd every few days and looked them over, but no daily attention was given them, as the pasture was provided with a running stream which provided plenty of water, and the pasture land was the source of a sufficient supply of food, no grain being needed.

One Sunday, while driving past the far side of this pasture on the way home from church, he noticed several buzzards circling over the trees, and decided to make a visit to the pasture and find out what had caused the buzzards to come on the farm. After dinner he went over to the pasture field, and, down in the hollow, near the creek, he found one of the large ewes had died, and the dead body was being torn apart by several of the hogs, aided by a swarm of hungry buzzards. As the dead animal was already pretty badly torn up, he decided to leave the hogs and birds to their feast.

Two weeks later, when he made a visit to the pasture, he noticed that several of the hogs were missing. On making an investigation and search for them, he found 4 of the animals down in the creek bed dead and a number of others in a very sick condition. Within another ten days he had lost nearly three-quarters of the entire herd, and before the outbreak had run its course he had only about a half-dozen left, and 2 of these so badly stunted that it was considered the best policy to knock them in the head.

Within a few days after the outbreak on this farm the disease began to make its appearance on farms further down the stream, and rapidly spread over a wide area, causing an enormous loss.

The outbreak in this case was almost unquestionably due to hog-cholera germs brought to the pasture by the buzzards which were attracted by the dead sheep carcass, as these hogs were far removed from any other herd and were not visited by anyone except the owner, and he only at rather long intervals. No new animals had been added to the herd, and there had been no cholera on farms higher up in the course of the stream so far as could be found out. The buzzards had, to all appearances, come from a distance of several miles over in Indiana, where an outbreak of the disease had been raging for several weeks.

This man's experience should serve as a warning of the extreme danger that follows allowing any form of dead animal carcass to be exposed where it will attract buzzards to the community. They are nearly always disease producers, and they come only when there is something there for them to feed upon.

Another common means of spreading a cholera outbreak is also brought out again in this instance, that is, the rapid rate of spread of this disease along the banks of a running stream. Especially is this likely to occur when, as in this case, dead carcasses are allowed to decompose and rot away in the bed of the stream.

Outbreaks of cholera are often marked by the fact that the disease breaks out on several farms which are widely separated from each other, and skips over farms located between. It is often hard to explain just why this should be so. A great deal of this mystery can be cleared up, however, if we but stop to consider the habits of the buzzard: the wide circling flights that he makes and

the fact that he may at any time release from his beak or claws pieces of dead meat which are full of the disease-producing virus.

No single means is so likely to cause widespread scattering of cholera infection as the turkey buzzard. While there may at one time have been apparently good reasons for protecting this bird by law, it would seem that the great financial loss for which he is indirectly responsible would make it advisable that this law be repealed. At any rate, there can be no question that it is absolutely inexcusable to leave exposed in your fields the carcasses of dead animals which are bound to attract these scavengers of the air and cause enormous money loss not only to yourself, but to the entire community in which you live.

Public Stock-yards.—Without question, the one most important cause of the spread of hog-cholera into widely scattered parts of the country are the public stock-yards. In every large city, especially at our great packing centers, we have located large public stock-yards in which animals are brought together from all parts of the United States. When cholera outbreaks occur large numbers of cholera-infected animals are shipped to these central markets and find their way into the hog alleys. As a result it may be said in a general way that all these public hog yards are infected, and likely to cause cholera to break out in any hogs that pass through them.

Not only are the hog alleys in these yards infected, but in many stock-yards no strict separation is made between the pens used for hogs and those used for cattle, and in case of overflow cattle pens may be used for hogs, and *vice versâ*. This results in a wide spreading of the cholera germs throughout the entire yards. Further, farmers and traders frequently are passing from one part of the yards to another, and it cannot be otherwise than that these entire yards become more or less filled with germs of cholera.

Not only is this true at the large centers, but it is equally true at local shipping points. Every country siding and village has its own small public stock-yards and loading pens from which hogs and cattle may be loaded on the cars for shipment. In the case of these local stock-yards there is nearly always no distinct, separate pens for cattle and hogs, and usually the same loading chutes are used for loading and unloading, and for all classes of animals.

When there is an outbreak of cholera on a farm, usually about the first thing the owner thinks of is to get the animals which are not yet sick off to market just as soon as possible. The result is that there are loaded through these local yards and chutes a number of sick animals. The discharges from these animals are capable of causing disease, and they leave behind them a diseased stock-yard. It is very seldom that the railroad company or anyone else has any local arrangement for disinfection of these pens after the sick animals have been loaded out of them. In justice to the railroad companies it should be said that the apparent neglect in this instance is not due to carelessness, but rather to ignorance of the danger, and most frequently they have no knowledge as to whether the herds shipped are diseased or not. The railroad companies are as much interested in the development of the hog industry along their lines as the farmers themselves, and are usually always ready to go to considerable trouble and expense to aid in the checking of the disease in the districts along their lines when they are shown the correct method of doing so. It is purely a commercial proposition with them. More hogs mean more freight, and more freight means more net earnings and bigger dividends.

As a result of the present methods of shipment and lack of proper regulation of public stock-yards practically every public stock-yard in the United States is a cholera-infected one, and any hogs coming through these yards are liable to become diseased. Especially is this the case where hogs are unloaded at a public stock-yard, fed and watered, and reloaded. Under such circumstances as these it is nothing short of a miracle if the animals escape getting cholera.

Hogs which have been shipped into large public yards, resold to shippers, and taken out to the farms as stockers are always very likely to develop cholera in spite of the best of sanitary conditions which may exist on the farms to which they may be shipped.

Not only are these public yards a source of danger to the hogs that pass through them, but they are equally dangerous when cattle, sheep, or horses are brought through these infected pens on the way from the large live-stock markets to the farms where they are

to be fed through the winter season. Cattle or sheep unloaded into these infected pens are bound to gather up on their hoofs a certain amount of the germ-carrying manure and mud from the diseased pens, and, as a result, they carry with them this cholera-producing material to their future home and distribute it liberally about the pastures. In the Central States it is almost always the rule to allow the hogs to follow the same range as the cattle, and as a result it is only a question of a few days after the arrival of the cattle until we are liable to have an outbreak of our old enemy, cholera, on the farms. The disease in these cases is often puzzling to trace unless you get at the facts correctly and properly understand the history you get. There may be no cholera for miles in all directions, and you may be absolutely at a loss to explain why an outbreak should occur. Very frequently these obscure outbreaks can be traced in just this manner.

There is another point in connection with shipment of live stock and the spread of cholera, and that is the use of cars which have become infected with cholera germs. For instance, Farmer Brown, living in Missouri, ships a carload of hogs to Chicago from a cholera herd. Some of the animals die on the way and the entire car is freely infected from the discharges of the sick animals. This car is swept out and re-used for shipment of a load of feeder cattle by Farmer Jones, in northern Illinois. There can be but very little question that these cattle when unloaded from the car are carriers of a large amount of hog-cholera virus, which they will distribute along the public highway and carry to the feed lots of Farmer Jones.

This, by the way, gives another illustration of how easily a public road may become infected, and is another argument why hog pastures should not be located in close contact with the public roadway.

All cars that are used for shipment of hogs should be immediately cleaned and disinfected, under United States Government supervision if possible, before being again allowed for use in shipment of live stock. This should be done regardless of whether the cars are intended for use in the shipment of hogs or other animals. While the danger is no doubt much greater if hogs are to be loaded back into these infected cars, the element of danger is

by no means to be overlooked when cattle, horses, sheep, or other animals are being loaded into the cars.

As an illustration of how dangerous these infected cars really are in the spread of hog-cholera the following experience may be of value:

A few years ago a stockman in eastern Iowa shipped two carloads of cattle to one of the large packing centers, and on the return trip went over into Kansas and purchased two carloads of feeder cattle for return to his pastures in Iowa. At this time cattle were offered for sale quite reasonable in the district in which he purchased his stock on account of the fact that a severe outbreak of cholera was at that time raging in the district, and the death of all the swine had made cattle feeding a rather unprofitable business.

The cars on which these cattle were loaded for shipment were some return empties that had been used for shipment of diseased hogs out of the outbreak district, and were undoubtedly infected cars, as they had been returned direct from the shipping point, and almost certainly without having any disinfection or cleaning done.

When the cattle arrived in Iowa they were at once placed in the feed lots which had been just occupied by the former herd of cattle. At this time there were in the feed lots upward of 100 head of hogs which derived their food-supply largely from the droppings of the cattle.

Two weeks after the new herd of cattle arrived the usual symptoms of hog-cholera began to develop in some of the younger swine. Loss of appetite, hiding in the litter, high temperature, cough, abdominal tenderness, diarrhea, and appearance of a weak, staggering gait in the hind legs soon made the diagnosis only too plain. Postmortem findings were of the usual character of the severe type of the disease. Within a week the herd had been reduced over half in number. The balance were loaded on the cars and shipped to market in an effort to lessen the loss as far as possible.

Here we have a case which illustrates a number of points in the prevention of cholera.

In the first place, it shows the danger of going into a cholera-infected district and buying any class of live stock which are to

be brought home and turned into the same feed lots with hogs which are not protected by proper immunization treatment. These cattle no doubt carried with them germs of the disease from the infected area in Kansas, where they had been pastured on infected feed lots. This would seem the more likely as the type of the disease which was developed in Iowa was very similar in character to that prevailing in Kansas.

The use of cars which were also likely infected was another point which would aid in the gathering of cholera germs upon the feet of the cattle. Cattle coming from an infected district and shipped in cholera-infected cars could hardly escape carrying with them sufficient of the cholera virus to sow the seeds of an outbreak in the new pastures into which they might be turned when brought home.

When we add to this the fact that the herd was unloaded through infected chutes into pens which had undoubtedly been occupied at some previous time by infected hogs, there can be very little difficulty in seeing why the outbreak of cholera followed so closely upon the arrival of the cattle from Kansas.

In addition to these points, we also have the likelihood of the owner himself carrying with him on his boots hog-cholera manure and mud from the Kansas feed lots which he visited while purchasing the cattle that were to be shipped to his own farm for feeding purposes.

An instructive example of the dangers which are found even in country public stock-yards is to be seen in the following experience of a stockman and feeder in southern Iowa: This man had just purchased a large herd of cattle at one of the principal market centers, and shipped them to his farm for feeding purposes. He concluded that he also wanted to turn a drove of hogs into the feed lots with the cattle to gather up the droppings from the cattle. He, accordingly, went down into the northern part of Arkansas and bought up a drove of over 250 head of perfectly healthy hogs. These animals were purchased in a district where there had been no cholera for two years and no cholera was present there or in the immediate vicinity at the time.

The hogs were shipped north, and on the way were unloaded for feed and water at a small railroad center in central Missouri.

Here they were unloaded into the pens of a public stock-yard, fed, watered, and reloaded. At this time there was a severe outbreak of cholera raging in the district immediately surrounding the city where this feeding and watering were done. Large numbers of cholera hogs on the way to market had passed through these yards during the previous week, and, without question, the pens were thoroughly infected with hog-cholera virus.

Within ten days after arrival of the hogs upon the farm in Iowa they began to show signs of sickness. Diarrhea, cough, unwillingness to move about, weakness of the hind limbs, bright red blotches on the skin, staggering, and death occurring within about three to five days after the onset of the attack, made the diagnosis very clear. Any doubt about the matter was at once settled when a postmortem examination was made, and showed the presence of numerous dark-red spots beneath the outer coat of the bowels, small red spots in the kidneys, lungs, and lymph-glands, and beginning ulcer formation in the bowels. Without doubt the outbreak was one of cholera. Rapid spread of the disease through the herd and to herds on the surrounding farms offered further evidence that the disease was hog-cholera.

Now these hogs were perfectly well when they left the feed lots in Arkansas, and had not been exposed to any infection there. There is, of course, a possible chance that the cars in which they were loaded may have been infected, but it seems much more likely that the infection was picked up in the public stock-yards in Missouri, which were unquestionably diseased by the passage through them of large numbers of cholera-infected animals without any effort being made to keep them free from infection.

The practice of allowing cholera-infected hogs to be handled in the same pens and loaded over the same chutes with healthy animals is a most important element in the spreading of the disease, especially on large farms where hogs are frequently shipped in for feeding purposes. Some provision should be made for regulating this shipping in such a manner that separate pens should be used for outgoing and incoming animals, and all pens should be thoroughly disinfected after each shipment passes through, and especially so if there is any possibility of the animals having cholera or of their having been exposed to the disease.

The matter of public stock-yards also again recalls the need for disinfection of cholera-infected cars. If the hog-raising communities of this country are to be properly protected against the spread of cholera, it is absolutely necessary that some action be taken in the matter of careful and thorough disinfection of all cars used in the handling of hogs. Every railroad car which is used for the purpose of shipping hogs should be subjected to a thorough cleaning and proper disinfection before being allowed for use again in shipment of live stock of any kind. The danger is almost equally great whether the car be used for the purpose of reshipment of hogs or for the shipment of sheep, cattle, or other live stock which are being taken back to the farms where they will come in contact with healthy hogs. The virus of cholera is very easily carried and can be carried with almost equal ease by cattle or sheep, as well as by hogs themselves.

Hauling of Hogs to Market.—In connection with the shipment of hogs out of cholera-infected districts we must take up a consideration of another source of danger which is often overlooked and which holds extremely large chances for possible harm.

In the hog-raising districts, when there is an outbreak of a disease on any farm which resembles cholera, it is a common practice to load up all animals which are suitable for sale and ship them immediately to market for the purpose of cutting down the loss to as small a figure as possible. This, too, by the way, is one of the reasons for the dwindling of the hog-raising industry, and is one of the sources of indirect loss from hog-cholera which is often overlooked when estimating actual losses from the disease. This shipment of young animals to the slaughtering centers is a very important reason for cutting down the actual number of hogs in the following year.

On such occasions as these it is customary for the neighbors of the stricken farmer to send a team and wagon and a man or two to assist in hauling the animals to market. Now this is a most praiseworthy, brotherly spirit, and is one of the many things that tend to the development of a much closer bond of fellowship in the farm communities than exists in our large cities, where your next-door neighbor would not turn his hand over for you, as a rule, unless he is to be paid for doing so in real money.

Unfortunately, however, this attempt to be of assistance to your neighbor often results in the introduction of the disease into your own herd. The manner in which this comes about is about as follows:

Twc or three years ago there was an outbreak of cholera on the farm of a Mr. Watson, over in eastern Iowa. He at once decided to ship out all the animals which were of sufficient size to go to market, and, as he had quite a large herd, he found it necessary to call upon several of his neighbors for teams to assist in the moving of the animals to market. As is always the case, the neighbors responded liberally to his request for assistance, and before daybreak on the following morning the animals had been loaded and were delivered to the cars before the sun had reached a high point sufficient to endanger the animals from overheating.

As it was warm weather, the wagons were freely bedded with wheat straw, and this thoroughly wet down with cold water, in order that the animals might be kept as cool as possible. Immediately after the animals had been loaded into the cars the various farmers returned to their own homes, taking with them the infected wagons. Some of the drivers washed out their wagons in town, and threw out all the infected litter and manure, others swept out the wagons along the road on the way home, while others let the litter remain in the wagon until they reached home.

One farmer, in particular, left his wagon untouched until he reached home, when he drove out back of the barn and, taking a broom and hose from the windmill, thoroughly swept out and scrubbed the wagon bed. Several small shoats which had the run of the barnyard were naturally attracted by the artificial mud-puddle thus formed, and immediately took to its use as a wallow for the day.

Ten days later several of these shoats were off feed, and within three days two of them had died. Postmortem findings and symptoms before death were absolutely those of cholera, and there can be but little question as to the method by which the infection was carried to the premises.

This man's experience was a most costly one to him, and, unfortunately, he undoubtedly is still in the dark as to the exact manner in which the infection reached his farm, but we are in a

position to draw profitable conclusions from this case which will be of benefit to us in preventing a like occurrence on our own farms.

Whenever you haul hogs to town for a neighbor, no matter whether the animals are believed to be suffering from any disease or not, immediately clean out your wagon bed as soon as the hogs are unloaded, and do not, under any conditions, take the possibly infected bedding home, to be left where your own hogs will have opportunity to come in contact with it and contract cholera or some other disease which may have been present in the other man's animals.

Destroy Useless Dogs.—Nearly every farmhouse has one or more dogs about. In some cases these animals are really valuable and well worthy of their keep. In a great majority of cases, however, dogs found in the country districts are worthless, and roam all over the fields of the farm and neighboring farms as well, looking for wild game and any other forage that they may come across.

Under ordinary conditions this daily wandering about of the dog may do no harm, but when there is an outbreak of cholera it holds great possibilities for aiding in the scattering of the disease throughout the neighborhood. The relationship between dogs and cholera outbreaks has already been referred to in one or two cases given as examples of how cholera spreads in a neighborhood, but the following additional cases will serve to show you how really important is this fact in the spreading of cholera to your farm:

In the spring of 1911 there was an outbreak of cholera on the premises of a farmer in northern Iowa. The outbreak was rather mild in character, and resulted in the death of about one-half the animals on the farm. It, fortunately, did not spread at this time to any of the surrounding farms, and the farmers of the neighborhood began to congratulate themselves on the fortunate outcome of what might have proved to be a most severe outbreak.

The animals which died on this farm were buried in an open pasture. The grave in which they were buried was about 4 feet in depth and simply filled in with loose earth. One of the neighbors living down the road about a half-mile had a large shepherd dog which was known all over the neighborhood, as he was a regular tramp, going away from the house every morning and

wandering about all day, returning home toward nightfall. He was a harmless animal, but at the same time was practically worthless as far as any real value went.

It was not until about the middle of June that Shep discovered the newly made graves in the pasture, and began an investigation on his own hook. He soon had burrowed down to the dead carcasses and unearthed one of the bones, which he proceeded to drag home with him. It was not many days until he had the barnyard of his home premises littered with all sort of remains of the recently infected cholera animals.

The hogs on this farm were kept in a feed lot immediately alongside the barnyard, but did not have the run of the barn lot itself. Several of the small pigs, however, had discovered holes along the fence through which they were able to crawl and make their way into the barn lot, and thus increase the size of their range.

As a result, it was not long until Shep had considerable opposition for possession of the remains of the cholera carcasses which he had dragged home. Also, it was but a little over a week after he began bringing home these virus-laden bones that the pigs on this farm began to show marked signs of severe illness. In a few days they were dying rapidly, and it was not long until the older animals had become infected through the diseased discharges of these pigs. The final outcome was that the entire herd was wiped out in the course of a month.

The outbreak this time did not stop at this one farm, but was rapidly spread, due to the fact that this last farmer was inclined to be a bit careless in the disposal of his dead carcasses, and simply hauled them over into a distant field and dumped them into a ravine. Here they were soon surrounded by an enormous flock of hungry buzzards, which aided in scattering broadcast the seeds of infection. In the course of a month hogs were dying by the hundreds over this section of the state, and the final summing up was a loss of several thousand dollars, which was traceable directly to one worthless dog.

This outbreak again serves to demonstrate the disadvantages of burial, even when properly done, as a method of disposing of dead animal carcasses. Had this first farmer burned his dead hogs instead of burying them he would have had a much easier

task, and at the same time he would have made it impossible for the dog to have obtained the infectious material which he carried to the second farm, and which became the source of the general outbreak in the late summer.

The dog mentioned in this illustration is only one of thousands of similar worthless animals that are being kept on the farms throughout the Central States. Many of these farms have as high as a half-dozen of these animals, and perhaps not one in the bunch is worth the feed he eats. Good dogs are valuable things to have, especially on a stock farm, but worthless hounds, which become neighborhood tramps, are not only worthless, but they may, as in this case, result in producing a great amount of harm. If you keep a dog let it be a good one that knows his place and is not found wandering all over the township.

Another example of how a perfectly valuable dog became the cause of scattering cholera on a farm is to be found in the following history: On a certain farm in central Missouri there was a well-trained dog, which was especially valuable in driving live stock of any kind. On an adjoining farm there was an outbreak of cholera, and it was decided to ship the herd out to market at once. As in practically all such cases the owner of the dog, with several other neighbors, went over to assist in loading the animals and getting them off to the shipping point. On account of his value as a hog-driver the dog was taken along to help in driving the animals.

During the herding up into the pens, and also while loading, the dog was one of the most active members of the party and performed as good service as any man could have done. When the loading was all over the owner and dog returned to their own home. This dog had a particular liking for live stock, and was always to be found out around the feed lots. Accordingly, he was not home long until he was out in his accustomed place among the cattle and hogs in the feed lots.

Ten days later the first signs of something wrong with the animals on this second farm were noted, and only immediate shipment of the herd to market prevented severe loss, as two of the sick animals, which were knocked in the head and afterward opened up for postmortem examination, showed typical lesions of hog-cholera in both the abdominal and chest organs.

Now in this case the infection was carried from the first premises most likely either upon the feet of the dog or upon the shoes of his owner. The owner claimed that he thoroughly washed off his shoes before leaving the infected farm, and so it would seem most likely that the infection was carried on the feet of the dog.

This case but serves to illustrate the many little things which must be watched if we are to prevent the entrance of cholera to new farms. This farmer was above the average in the knowledge of the methods of spreading cholera, and went so far as to take the precaution of thoroughly cleaning his own shoes. It did not occur to him, however, that the feet of his dog were as capable of carrying the infection as his own, and no attention was paid to washing the feet of the dog. It is, as a rule, just little things like this which result in the outbreak of hog-cholera in a herd. Truly, indeed, may it be said that "eternal vigilance is the price of freedom from cholera." You must be continually on the outlook for any possible source of introduction of the disease to your feed lots, and be prepared to take any necessary steps to ward off the threatened outbreak.

Chickens and Pigeons.—On almost every farm chickens are given the range of practically the entire premises, and, where two farms closely adjoin each other, it is a very common thing, indeed, for the chickens to cross freely from one farm to another. Chickens are especially likely to be found in feed lots, as they are always afforded here an ample opportunity to gather food. If two feed lots lie close to each other, or lie across the road from each other, it is very common for the flock of chickens to be found with almost equal frequency in one feed lot or the other.

Chickens are nearly always to be found on the public roads, and when these roadways have been infected by the passage along them of a drove of cholera hogs, or a string of wagons loaded with cholera animals, it is not long until the chickens have scratched around enough in the litter and manure which are left behind to carry infection on their feet to the animals in the feed lots.

Examples of outbreaks of cholera which have been spread in this easily overlooked manner are not hard to find. Two rather interesting examples which I recall are the following:

Farmer A and Farmer B lived just across the road from each

other, and each had a large feed lot facing on the public roadway. Farmer A had a large flock of chickens which derived their livelihood almost entirely from what they were able to pick up in the feed lots following the cattle and hogs. The chickens were in the habit of crossing the road over into the feed lot of neighbor B with about the same freedom that they enjoyed in their home feed lot. In the latter part of August B took some select animals of his herd and exhibited them at a county fair a few miles distant. Upon their arrival home from the county fair the animals were apparently in first-class shape, but four or five days later they began to appear a little off feed, and within two days developed all the symptoms of old-fashioned hog-cholera. The disease spread rapidly through the herd and the death-rate was very high.

A did not at any time enter the infected feed lots of B, and there was no direct communication of any kind between the two herds of hogs except that established by the chickens passing back and forth across the road. Within two weeks after the outbreak on B's farm A noted that several of his hogs were refusing feed. He telegraphed at once for a car and shipped them all out to market. On the way 3 died and 5 were condemned at slaughter.

This outbreak brings to our attention a new source of danger that is frequently entirely overlooked. This is the great frequency with which hogs may become infected while being exhibited at stock shows, county fairs, state fairs, and like exhibitions, where there are collected large numbers of hogs shipped from various parts of the country. Almost invariably there are one or two cholera-infected animals in such an exhibit, and it is not long until the exhibition grounds are well filled with the infection, and a severe outbreak may even start up right on the fair grounds. This in itself is bad enough, but is a very small loss compared with the losses which more frequently occur as the result of the development of the disease in the animals after they have been returned home and again placed in the pens with the regular herd.

This outbreak also shows with what frequency cholera is carried by apparently unimportant means. Now, in this case, A purposely remained away from going into B's feed lots, as he had heard that it was possible to carry the infection from one farm to another. It never occurred to him, however, that the flock of chickens which

had the run of the cholera feed lots as well as their own might be capable of carrying the disease across the road into his lots.

As has already been stated on preceding pages, the infection of cholera is not carried for any great distance through the air, and rarely indeed would be carried as great a distance as that which existed in this case by means of air alone. The only direct communication between the two feed lots was by means of the flock of chickens mentioned, and it would seem almost a certainty that they were the means of bringing the disease to A's animals.

In connection with this outbreak there was another incident that occurred that is worthy of note here. Both of these men had a fairly good knowledge of cholera and its catching nature. They, accordingly, used every precaution to keep the disease from spreading. All dead animals were burned every morning on B's farm, and those that died on A's before shipment were immediately burned. Both feed lots were afterward cleaned most thoroughly and sprayed with a strong disinfecting solution. As a result the outbreak was kept on these two farms and made no advance to adjoining farms. This is a striking contrast to the results that we have already seen in our investigation of other outbreaks where these precautions were not taken, and where the outbreaks have rapidly extended to involve a wide area, producing enormous financial losses as well as very great damage to the hog-raising industry for years to come in these cholera-swept districts.

As further proof of the effects of proper sanitary efforts it might be added that A, mentioned above, brought a new drove of hogs upon his premises three months later and turned them into the infected pens. As we have already seen in cases where the pens have not been thoroughly cleaned out and properly disinfected, this practice would mean the death of a large percentage of the new animals within three weeks after they had been introduced into these pens. In this case, however, there was not a sign of cholera in the new animals, and we can explain this fact only by the thorough cleaning which was done after shipment of the infected animals, and the proper disinfection of the pens which followed this cleaning-up process.

In the farming district of the Middle West and, in fact, in practically all parts of the country very frequently we find a

large flock of pigeons making their home in the lofts of hay barns, wagon sheds, corn-cribs, cattle sheds, or other like places. Especially is this frequently found on farms where cattle are fed. Pigeons find cattle feed lots a most profitable source of food, and they are usually always to be found on these farms where cattle are kept.

The pigeon is a more or less handsome bird and one that is usually considered as desirable by most farmers. They are especially favorites where there are children, and we can most of us remember as boys many hours of pleasure spent in building cotes in which these birds might nest.

One of the peculiar habits of the pigeon is its tendency to do considerable flying from one farm to another, especially in the spring of the year about nesting time. At this season the birds usually visit several of the adjoining farms, and apparently look them over with a view to their desirability as locations to live, much as the members of the human family of our cities go out flat hunting at the commencement of the spring season. In almost all seasons of the year the pigeon is found visiting several of the surrounding feed lots at irregular intervals. Wherever cattle are kept, there also we usually see hogs. Now with these facts before us, and the knowledge which we have of how hog-cholera may be spread from one farm to another, it is not difficult for us to see how the apparently harmless pigeon may carry enough infectious material from one feed lot to another to set up an outbreak of hog-cholera over a considerable local district. Evidences of this fact are to be found in the following case history:

In a certain district of central Ohio there were several cattle and hog feeders located within a distance of a few miles. On one of these farms in particular there was an enormous flock of pigeons, which made their home in the loft of a large hay barn. These birds, several hundred in number, made frequent excursions to surrounding farms in search of such food as they might be able to gather in the feed lots.

About the middle of summer there was an outbreak of cholera on one of the farms nearly a mile distant from the one which furnished the home for the birds. This infected farm was one of

those visited by the pigeons, however, in their daily flights. It was not long after the animals began dying on this first farm that the disease made its appearance on the farm which served as the home roost for the pigeons. In the course of a month it was quite widely scattered through the neighborhood, and a noteworthy fact about this outbreak was that those farms which became infected first were those which were in the habit of being visited by the flock of birds just mentioned. As there was no direct communication of any other sort between these various farms, and every care was taken in the burning of dead animals, the conclusion must, of necessity, be drawn that the most important cause for the spread of the disease was these pigeons.

In connection with this outbreak it is worthy of mention that the source of the outbreak on the first farm was the shipping in from Wisconsin of a boar which had been guaranteed as immune to cholera, as he had already been through an attack and had apparently entirely recovered. The after-results, however, would make it seem that this boar was one of those cases which I have already described, known as "carriers."

These carriers are animals which are throwing off hog-cholera germs in their manure and urine, but who do not themselves show any evidences of the disease. Unfortunately, we have no practical way of determining which animals are "carriers" and which are not. In a general way it may be stated that animals which have suffered from a chronic form of the disease are more likely to afterward prove to be "carriers" than those which have been affected by the acute type.

There was another occurrence in this outbreak that is well worth mentioning. All the farms on which the disease made its appearance were owned by men who were quite well posted along the lines of prevention of cholera. Many of them were men who had attended the Agricultural Department of the State University, and every precaution was taken to prevent the scattering of the disease. All the dead animals were promptly burned or buried in quicklime and crude sulphuric acid. As a result, there was not a single buzzard seen in the vicinity during the entire time the outbreak was in progress, and the disease reached only one or two farms where its course could not be traced to the daily flights of the flock

of pigeons, which are believed to have been the principal cause in the spreading of the disease.

Another interesting case, in which hog-cholera was probably brought to the farm by chickens, is the following one: One of the most prosperous farmers in central Indiana had been especially fortunate for a number of years, in that cholera had not made its appearance in his herds. This man was a careful feeder, who took excellent care of his animals, kept his feed lots in a thoroughly modern, sanitary condition, and to these facts he attributed his freedom from cholera.

In the spring of 1912 he purchased a number of chickens for breeding purposes from a chicken dealer who chanced to stop at the house for dinner, and who had an unusually fancy flock of chickens which he had purchased the day before from a farm located several miles distant. It afterward was found that the farm from which these chickens were bought was the seat of a severe outbreak of hog-cholera.

About two weeks after the chickens were turned loose in the barn lot a couple of the young pigs were noted to be off feed. The next morning several more were found to be off. The farmer had been free from cholera for so many years, and, as there was none now in the vicinity, he could hardly believe it possible that his hogs were suffering from cholera. He sent for a local veterinarian and had a postmortem examination made of one of the pigs which had died. The usual findings of hog-cholera were present, and only prompt shipment of the salable hogs prevented several hundred dollars' loss.

Hog Buyers, Butchers, Etc.—This is a constant source of danger, and one which is usually entirely overlooked. In every farming community there are several men who make it a regular business to go about the country purchasing hogs, which they ship in carload lots to the principal markets. These animals are purchased on a basis which will allow the buyer a reasonable profit on the transaction.

As a natural matter of course when one or two hogs in a herd begin to get off feed, and there is an outbreak of cholera in the neighborhood, one of the first things which is done is to call up one of these buyers and have him come out and have a look at the

animals, with the object of immediately shipping as many of them as are in condition to go to market.

It is only natural also that under such conditions as these the buyer will want to go into the feed lots and carefully go over the animals before making any offer for purchase of the herd. As a result, his shoes usually become quite thoroughly covered with disease-producing material, and when he leaves the premises he is in first-class shape to spread the infection on the next farm which he visits.

As an example of how easily infection may be spread from this source, I would call attention to the following outbreak which occurred in east central Illinois a few years ago.

Cholera made its appearance rather suddenly on the farm of a large stock raiser living out about seven miles from the county-seat town. He at once called up one of the leading local shippers and had him come out and look the animals over with a view to their purchase. The buyer arrived in due course of time and, going into the feed lot, made a careful examination of the herd, and finally arranged to ship them on a commission basis.

On the way back to town he stopped at five other farms and went into the feed lots of each farm to look over the herd of hogs. In all of these cases he failed to make a trade, as the owners were of the opinion that their hogs were hardly ready for market.

In a little over a week from this time cholera made its appearance on three of these five farms, and by the end of the second week the disease was well established on all five of the farms which had been infected by this one buyer. This is an excellent illustration of just what may happen in any herd where strangers are allowed to enter the feed lots. It should be your invariable rule that no one shall enter your feed lots who has recently come from another man's farm where hogs are kept, and especially should this be the case where the stranger is a hog buyer, butcher, or others who make it their business to trade in live stock. When such men come to inspect your animals, with a view to purchase or otherwise, have them remain outside the fence while you enter the feed lot and drive the hogs up along the fence where they may get a good view of them.

No man will refuse this request when you tell him your reasons

for making same, and if he does, it is better that he should think that you are a bit cranky, if he wants to have it that way, than that your herd should develop cholera. With a more thoroughly widespread knowledge of cholera and the multiple ways by which it may be carried there will be a better appreciation of these dangers and less spreading of the disease by means that could be prevented.

Addition of New Hogs to the Herd.—We now come to a place where the saddest pages of hog-cholera history have been written. Many and many are the farmers and stock raisers who have gone to great amount of trouble and considerable expense in selecting and purchasing new animals to add to their herds for the purpose of improving their breed, only to find that they have been the means of introducing the dread disease, cholera, with the final wiping out of the entire herd.

This chapter of hog-cholera history is the more sad when we stop to consider that these fearful losses could have been in large measure prevented had the owner been properly aware of the dangers attendant upon bringing in new swine, and the proper methods of handling them to prevent spread of any disease with which they might be affected to the balance of his herd.

Last summer a prominent stock raiser in central Ohio sent over into Pennsylvania and purchased 5 thoroughbred brood sows, which were crated and shipped to his Ohio farm. The animals had only recently been exhibited at a county fair, and had been returned prize winners. Ten days after their arrival at the Ohio farm they began to show evidences of being sick, and within three weeks from the date of their arrival they were all dead and over 50 per cent. of the regular herd were developing unmistakable symptoms of cholera.

Here we have an excellent example of the dangers of adding newly purchased hogs directly to the home feed lots. If these animals had been kept separate for a few weeks, say, thirty days, it would have been found out that they were developing cholera, and with very little additional precautions the home herd could have been saved from exposure to the disease and the enormous loss which resulted could have been saved.

This case also presents an interesting problem as to how the infection of these incoming swine took place. It is most likely

that they were infected while on exhibition at the district stock show, and did not develop active symptoms of the disease until they had arrived in Ohio. Again, there is the possibility that they may have become infected while in transit, or by being unloaded over infected chutes at the local railroad yards. In any case, the outbreak at least shows the great danger which attends bringing in new animals and adding them directly to your feed lots without first placing them in temporary quarters removed some distance from the home herd, and allowing them to remain thus quarantined for at least thirty days. It is a little inconvenient sometimes to do this, but it is decidedly more inconvenient to bury or burn several hundred dollars' worth of dead hogs.

Another practice which is somewhat similar to this is the neighborhood ownership of a boar, which is taken from one farm to another for service. Such animals are not infrequently the cause of carrying infection from one farm to another.

In a certain district in central Illinois a neighborhood boar of this kind was kept. He had been used during the early spring by one farmer, and early in May was taken to a second farmer for service. About a week after he left the first farm hog-cholera broke out there, and a couple of days later the boar began to show unmistakable signs of cholera. He was separated at once from the sows, and passed through a mild attack of the disease, from which he entirely recovered. Ten days later, however, several of the sows were off feed and two died within the next two days. Prompt administration of serum in this herd stopped the outbreak, with the loss of but one more sow, but there can be no question that the disease was carried to this farm by the boar, and but for the prompt use of free doses of serum serious losses would have resulted. As it was the loss was over $100, as the animals lost were all valuable, high-class sows.

Another dangerous plan is to send sows away to breeding farms to be bred. This is always an undertaking accompanied by great danger, as there is the chance of infection in the cars both going and coming, and also the danger from infection on the premises, either from the home herd or from other sows sent in for breeding purposes.

In illustration of a case of this type, I recollect an incident

which occurred on a breeding farm over in Iowa a few years ago. A certain breeder was in the habit of receiving sows from the surrounding district for breeding purposes. During this particular season he had at one time several sows on the premises from different parts of Iowa and Nebraska. One of these sows just before leaving showed signs of sickness, and died within two days after returning home. Postmortem evidence proved the diagnosis of cholera. As all the animals on the breeding farm were immune, it was not likely that the sow was infected on the premises, but more likely that she became infected while in shipment.

In any case her manure and urine were most certainly infectious during the last few days of her stay on the premises, and within a week after their return home several of the sows that had been in the breeding lots at the same time with this animal became sick, and were the means of starting several scattered outbreaks of cholera in the districts from which they came.

This case serves to illustrate how even the apparently impossible may happen. The herd on this breeding farm were all immunized by the serum-simultaneous method, yet this one sow, which undoubtedly contracted the disease from exposure while on the way, was sufficient to infect the breeding lots, and the result was a scattering of cholera over a circle several hundred miles wide.

As a matter of interesting note it might be added that in this case none of the animals belonging on the breeding farm became sick during this time or afterward, they having all been thoroughly protected by the immunity given through simultaneous injection treatment.

Exhibiting at Fairs.—The danger which attends this practice has already been referred to. Nearly every fall at some of the state fair meetings there is an outbreak of cholera among the hogs which are exhibited, and it is a very frequent occurrence for the disease to break out in prize-winning animals after they have been returned home. In the fall of 1912 there was a very severe outbreak of cholera on the fair grounds at one of the large state fairs in the Central West.

I have seen several cases where animals were sent to exhibit at county or state fair meets and have developed genuine cholera

within a few days after their return home. In the majority of these cases the infection takes place from contact or direct association with cholera animals, or from being placed in diseased pens. There are so many sources of danger at a great public gathering of this kind that it would seem very inadvisable to send any animals to an exhibit or state fair unless they have been previously immunized by a proper serum-virus simultaneous treatment. It is only by such means as this that we can hope to keep them free from cholera. Not only the hogs intended for exhibit at the fairs, but the entire home herd should be so immunized, in order that there may be no danger from infection by diseased material brought home with the prize-winning animals.

Recently, I had occasion to see an outbreak of cholera produced through exhibit of animals at a local county fair. The farmer upon whose farm the outbreak took place had some especially choice Chester-Whites which he was exceedingly proud of, and he sent 5 of the finest of the lot to be entered in the competition at the county fair held at the county-seat in September.

These animals were especially fine in appearance, and apparently in the pink of health when they left the farm. At the fair they were admired by all that saw them, and when the judges made their awards the blue ribbon was placed on this lot. Six days after their return home one of the animals was noted to be a little slow about coming out of the pen. He stood with his back arched a little and the belly drawn up. The hind feet were slightly crossed, and the animal apparently had little disposition to move about. When driven up to the feed trough he merely sniffed at the food, drank a little of the fluid, and then slowly returned to the litter in the shed. The next morning he was found dead. Post-mortem examination revealed all the signs of cholera. In a couple of days two more of the show animals were sick, and only prompt shipment of the entire herd saved an enormous loss, and even then the loss was considerable, as two of the prize-winning animals died, and the entire herd had to be sold at market price, whereas they could have been sold at a considerable premium as breeding stock.

In every case where animals are to be exhibited at fairs of this kind one of two plans should be followed. The best plan is to

have the animals while still small simultaneously treated, and thus made immune for life against the hog-cholera disease. In this manner you need not be afraid to place your animals on exhibition anywhere, as there is no danger of them contracting the disease if they have been properly immunized with reliable serum and strong virus.

Where, for any reason, it is not desired to carry out this method of protection, the next best thing is to keep the exhibited animals in a separate pen, far removed from the other animals of the herd, for at least thirty days after their return home. In this manner you will be able to keep the outbreak confined to the show animals in case you are so unfortunate as to have had your animals infected. The first plan is by far the better, but when not carried out the second plan will at least keep the loss down to a low point, as compared to that which would take place in case the entire herd were infected. In case of very valuable animals, it is an excellent plan to separate them into separate pens, with one animal in a pen. By such means it may be possible to prevent the loss of more than 1 or 2 animals, where otherwise there might be a loss of the entire number exhibited. As these animals are usually quite valuable, the saving of even a single animal that might otherwise have been lost is worth considering.

Other New Animals.—In connection with the relation existing between hog-cholera and public stock-yards, we have already considered more or less thoroughly the relationship which may exist between the outbreak of an epidemic of cholera and the bringing of a new bunch of feeding cattle or sheep into the feed lots. This is, however, such a fruitful source of danger, and one which is so commonly entirely overlooked, that I cannot but mention a few more words of warning on this subject.

We must get it thoroughly in mind that the virus of cholera passes from the body of the sick animal in all of his body discharges. The manure, the feces, the saliva, and even the sweat are infectious and capable of transmitting the disease to other animals. Cars in which cholera hogs are shipped to market are covered with 1 to 2 inches of decidedly disease-producing manure and dirt when unloaded. If these cars are re-used, without thorough cleaning and disinfection, for the shipment of cattle or sheep or other swine

back to the farms, there can be but one outcome. Cholera is as certain to follow the trail of such shipments as the sun is to rise.

The split hoof of cattle makes them especially likely to gather up and carry for a considerable period the disease-carrying material of cholera. The manure, dirt, and soiled litter becomes embedded in the cleft between the two sides of the hoof, and it is only by most thorough cleaning that it can all be removed. The animal might travel several miles after unloading, and still carry enough cholera virus into the feed lots to form the start for an outbreak of the disease.

One of the most interesting examples of this kind of infection was reported to me recently by a friend in the state of Michigan.

It appears that three farmers, living as close neighbors to each other, made the decision that they would go into the cattle-feeding business. They, accordingly, sent two of their number out into Nebraska for the purpose of purchasing four or five loads of feeders, and shipping them home to be placed on their feed lots.

The cattle were purchased in a few days, and shipped in cars which had probably been recently used for the shipment of hogs or other live stock, although, as to this, my correspondent is not certain. However, on the journey eastward it was necessary that the cattle be unloaded, fed and watered, and reloaded. This was done at a public stock-yard en route, and the cattle were here left out of the cars over night and allowed to rest in the stock-yard pens. These pens were used both for the handling of cattle and hogs, and it is quite likely that cholera hogs had been shipped out of these yards at a date only a few days previous. This, of course, made the yard an infected premises, and the cattle evidently took up a considerable amount of the infectious material with them.

On their arrival in Michigan they were divided up among the three farms and placed in the feed lots. Each of these farms had a large drove of hogs, and, as is the usual custom, the hogs were allowed to run behind the cattle for the purpose of gathering up any waste corn or other food that passed through the stomach and bowels of the cattle undigested.

About twenty days after the cattle had been received a few

of the hogs on one of the farms were noted to be off feed, and within a week there were sick hogs on all three of the farms to which these cattle had been taken. The condition at first was believed to be indigestion, as there had been no cholera in the vicinity for nearly two years. The symptoms, however, soon became exactly those of cholera, and postmortem examination of one of the animals that died showed the characteristic button-like ulcers of cholera throughout the small and large bowel, enlarged blood-stained lymph-glands, small red spots in the kidney, and other evidences of old-fashioned cholera.

The healthy animals were at once shipped out to market, and the dead were thoroughly disposed of by proper burning. As a result, the outbreak was smothered at its outset and did not spread to any farms except the three originally infected. This serves as an excellent example of what may be accomplished in checking an outbreak of cholera if the disease is recognized early and prompt measures taken to stamp it out, including a proper disposal of the dead carcasses. Burn all your dead animals, and you will have taken a big step forward in the direction of checking the progress of cholera.

The fact that the disease appeared on all three of the farms to which these cattle were distributed, and the further fact that it did not make its appearance on any other farm in the neighborhood, is very convincing evidence that the germs of infection must have been brought in with the newly purchased cattle. Where these animals picked up the infectious material is more or less uncertain, but it would seem most likely either that the cars in which they were shipped had been recently used for the purpose of shipping cholera-infected hogs to market, or else that they picked up the infection in the public stock-yards where they were unloaded for purposes of feeding and watering.

In either case, it shows us two great possible sources of danger in connection with the spread of cholera. All cars which you are going to use for shipment of cattle to your feeding lots should be first thoroughly disinfected and cleaned. In like manner we should avoid shipping cattle from points so far distant that it will be necessary to unload and feed and water the animals, especially at a public stock-yard, where there is great danger of further chances for

gathering infectious material to be transported to the home feed lots and set up an outbreak of cholera among your hogs.

Infection of Public Roads.—This should be prevented in so far as possible. There are in every neighborhood frequently to be found farmers whose hogs are as likely to be found upon the public road as they are to be in their home feed lots. In case the herd of such a farmer becomes infected it is not long until his animals have spread the infection all over the neighborhood. By their presence on the public roads they themselves are more exposed to the infection and, at the same time, more likely to scatter the disease over the community. There should be an absolute enforcement in every community of a law which makes it necessary for everyone to keep hogs off of the public roads.

Whenever there is an outbreak of cholera on a farm it is the usual rule to immediately ship all the animals that are anywhere near in condition to be profitably sold. This is a practice which cannot be condemned under present conditions, as the results of recent outbreaks have been the total loss of entire herds, or a very high percentage at least, while of those that do survive the attack very frequently there are several which remain runty and never do well afterward.

There can be no severe criticism for a man who tries to save himself as much of the loss of possible. The present regulations governing the meat-inspection judgment of cholera hogs, however, makes this shipment of diseased animals far less profitable than it was in former years. By a recent ruling of the Bureau of Animal Industry no animals can now be passed for food if they show even slight positive evidence of cholera, while well-marked lesions in even one organ is sufficient evidence on which to condemn the entire carcass. In addition to this the Federal Inspectors are now taking temperatures of all suspicious animals, and any that show a temperature of 106° F. or above are condemned if on postmortem they show any signs of the disease. This is a very decided change from the old regulations which permitted the passage for food of animals in which the changes were slight, and only provided for condemnation in those cases where the changes were well marked and quite widely distributed. This change will make a great deal of difference in the returns which will be received from the ship-

ment of cholera-infected herds, and will, in large measure, check this practice.

In any case where cholera-infected herds are being shipped to market it should be the duty of state sanitary officers to see that proper rules are enforced, which will make it necessary to move these animals under such restrictions as will protect from danger the herds which may be located in fields close to the roadway traveled over. It should be required by law to have such infected animals in wagons provided with tight box beds, and not in the ordinary open-crate wagon beds, which allow of the scattering of disease-producing discharges and infected litter all along the road.

Driving of infected herds along the public highways should be absolutely forbidden.

Stray Hogs.—I recall several outbreaks of cholera which have been started through the coming upon the place of a stray hog. One such outbreak, in particular, I received the history of while engaged in the hog-cholera eradication work in Pettis County, Mo., in the summer of 1913. The farmer who had this costly experience had quite a large grain and stock farm with a herd of nearly 100 hogs. One morning, when the hired hand went out into the field to do some plowing, he found a strange hog out in the field. This animal was a rather runty-looking shote, but did not at that time appear to be sick.

The strange hog was brought into the barn lot and held awaiting the claim of an owner. As no one could be found to lay claim to it, the pig was turned into the regular feed lot. A couple of days later the hog was noticed to be quite sick and to be suffering from a marked diarrhea, which was of a black, nasty, stinking character. Within a couple of days the pig died, and the carcass was left in the feed lot to be eaten up by the other hogs.

In less than two weeks after the death of this strange pig there was noticed a change in appearance of several of the native herd. These animals dropped off feed, appeared a little stiff behind, seemed to prefer to remain huddled up in the litter rather than to come out to the trough and eat, and when aroused stood about with the backs arched, flanks tucked up, and the hind feet crossed over each other or held close together. Several of the animals had a considerable amount of cough. Some were constipated, and

others were commencing to develop severe scours. The diagnosis was too plain to be mistaken for anything else. The tramp pig had died of cholera, and the home animals had been most thoroughly infected by being in the same feed lot with him, and, finally, by eating of the dead carcass.

So thoroughly widespread was the disease in the herd that only a little over 40 per cent. of the animals were salable when the shipment reached the market. The disease appeared to be especially severe in type, and one or two of the animals which had been cut open after death were described as having a very much inflamed appearance of the internal organs. The disease had evidently been of the acute severe type. The enormous loss resulting from this outbreak had so discouraged this man with the hog-raising industry that at the time I visited his farm, several months later, he had only three or four hogs on the place, and he was apparently firmly established in his resolution never again to risk costly grain and other food in such an uncertain animal as the hog.

There are several very profitable points that we may learn from this man's costly experience.

First of all, it warns us against the danger of allowing stray animals of any sort, and especially stray pigs, to come upon our premises. We should keep our road fences so repaired and have them so constructed that it will be impossible for stray pigs to get into our fields. In addition to this, it is also an excellent plan to keep our hog pastures so located that the animals do not come in close range of any public highway.

This outbreak also teaches a lesson in the danger which is associated with adding new hogs to our herd, no matter from what source they may come, unless we first keep them under daily care in proper quarantine quarters for a period of at least three weeks, and preferably for a period of thirty days. Had this been done in this case the animal would have developed cholera and died long before the quarantine period was over, and the animals in the regular herd would not have been subjected to exposure and infection.

Finally, this attack shows the absolute danger of allowing your hogs to eat the dead carcass of any other animal that may die, no matter what its source may be. In this case the eating of the dead

carcass resulted in the infection very rapidly of a large number of the herd, and resulted in enormous loss, even in spite of prompt efforts to get the animals to market.

Exchange of Work.—Exchange of farm work is a routine occurrence in every farming community. Especially is this a common practice at certain seasons of the year, such as threshing and haying time and corn-shelling. Perhaps the most extensive exchange of labor occurs at threshing and corn-shelling time. This mutual helping system is a most praiseworthy one, but it has possibilities for harm in connection with spread of hog-cholera which must not be overlooked. It is usually at this season of the year that hog-cholera is most widespread throughout the Central West, and in traveling from one farm to another it is very easy for such a large body of workmen and teams to widely scatter the disease over a very wide district.

It is a very common custom to do the threshing in the hog lot, in order that the straw stack may be convenient for the animals to sleep around during the winter months. As has already been described, very frequently artificial hog sheds are made by stacking the straw over a wooden framework constructed for this purpose.

Now, if cholera be present in a herd, and the members of a threshing crew work around this feed lot for a day or two, as is usually the case in threshing, it is only too plain that they will carry away with them a large amount of the infectious material. This is not only carried to the next farm to which the crew moves, but each man carries home with him a certain amount of this disease-producing material each night to his own feed lots. As a result, it is not strange that we find hog-cholera tends to spread very rapidly at this season of the year.

I can well remember a most violent outbreak of hog-cholera in western Illinois several years ago which was scattered in just this manner. The deadly nature of this outbreak was most severe, and practically every farmer who was a member of the threshing crew in this circuit had an outbreak of the disease on his premises. I remember visiting one farm while the crew of threshers were there, and I found the threshing operations being carried on in a large feed lot, while over to one side, not over fifty yards from the engine,

two boys were engaged in digging a grave in which to bury a number of dead hogs which had been gathered up that morning.

This method of spread of cholera is easily avoided if we will but follow a few ordinary precautions. Threshing should not be done in the feed lots. Not only does this expose every member of the crew to the danger of carrying home cholera infection to his own herd, but there is also another good reason, in that it is not healthy for your own animals to allow them to burrow around a straw stack during the winter. It will result in their having a cough all winter, which will so lower their vitality as to make them easy victims for any infectious disease that may happen to make its appearance.

Another precaution, which we can all very easily observe, is to thoroughly wash off our boots or shoes before leaving any strange premises, and especially so if we have been working around the feed lots or if we know that there are sick hogs on the place. In case there is cholera on the place, keep away from the feed lots and do not unnecessarily expose yourself to the danger of carrying infection to your own animals.

I remember, while in Missouri last summer, of visiting a farm on one occasion where there were several hogs sick with cholera. There was a corn-shelling crew working on the place this same morning, and a number of men, while waiting for their turn to load their wagons, were spending the time in examining the sick animals and walking about the pens. These men were all instructed to thoroughly wash their shoes or boots in a strong solution of the liquor cresolis compound, described on a preceding page, before leaving the premises. This was done, and we had no outbreaks that could be traced to this source. But for the prompt action taken here to prevent carrying away of the infection we might soon have had a widespread scattering of the disease throughout the entire district through infectious material which these men would have unknowingly carried home to their own feed lots.

As to cleaning of boots and shoes in a case of this kind, it is always preferable, of course, where possible, to use some good antiseptic substance, such as the liquor cresolis compound, which appears to be especially effective in destroying the virus of hog-

cholera, but this is by no means absolutely necessary. Any other good antiseptic, such as the various coal-tar dip preparations, is effective, or, for that matter, just plain ordinary water, if thoroughy used, will remove all disease-breeding manure, litter, mud, etc. It is a very simple and cheap precaution, and one which will save you hundreds of dollars some time if carried out thoroughly.

Proper Treatment of Other Diseases.—Neglect of the ordinary diseases of swine is a very common practice among farmers and stockmen. It is doubtful if any other animal on the farm receives as little actual attention as the hog, and yet there is probably no class of live stock that shows as large and as quick returns on the money invested in them as swine. The common practice among farmers is only too frequently simply to place the hog in a filthy pen, feed him on any old thing that no other animal will eat, provide him with a more or less plentiful supply of sour swill, and then it is a case of "root hog or die."

It is this class of hog raising that results in the breaking out of cholera every year, and then these same people, who are so careless with their swine while in health, are very frequently about the same with respect to disposing of the dead carcasses. The result is the attraction of an enormous swarm of buzzards, and in a few weeks the disease is spread broadcast over the entire community.

Cholera and Typhoid.—Many readers have no doubt noticed how common it is to find an outbreak of hog-cholera on a farm, and at the same time, or soon afterward, to have an outbreak of typhoid fever among the members of the family. This is an occurrence that very frequently happens. Now, hog-cholera and typhoid fever have many points in common—both are diseases which are characterized by a marked ulceration of the bowels, and both are diseases which are produced and scattered largely through neglect. Typhoid fever practically never occurs except through neglect by some one either directly or indirectly associated with the patient. We have already seen how carelessness at a dairy farm has resulted in widespread outbreaks of typhoid in adjoining cities. So it is that we find that those who are a little inclined to be careless with the handling of their hogs are frequently none too clean about their own household, and as a result they frequently reap the reward of

their own neglect, as well as does the poor hog who is unable to offer any resistance to this form of mistreatment.

Stomach and Bowel Diseases Due to Neglect.—Improper food and improper methods of feeding never fail to produce stomach and bowel disorders and diseases. In a great number of cases these stomach and bowel diseases are accompanied and made worse by the presence of intestinal worms of various kinds. These worms do not of themselves produce cholera, but they do create a condition of the mucous membrane of the stomach and bowel which makes it very easy for the animal to fall a victim of the virus of hog-cholera if it makes its appearance.

Treat Hogs at First Sign of Danger.—If we are to keep our animals healthy these common diseases must receive proper attention. Do not wait until the animals are run down from disease of the stomach and bowels and beginning to show signs of cholera before starting to give them attention and then expect to save them. The time to get busy is at the first sign of danger. Just as the first loose spike along a railroad track is the signal for prompt repair, so it should be here. The railroad companies do not wait for a loose rail to throw one of their speedy passenger trains into the ditch before making the necessary repairs; so we should not wait for cholera to get a foothold in our herds before giving them proper attention if it is needed.

Intestinal worms in pigs and hogs are so commonly neglected that a great many owners have come to regard them as rather normal inhabitants of the stomach and bowels in these animals. Such is not the case, however, by any means. While it is true that, as a rule, these worms do not produce severe symptoms, yet no pig will thrive as well with them present as it will if they are absent, and so we should make it our duty to rid our hogs of them at the first sign of their presence.

There are a number of remedies which may be used for the purpose of freeing your animals from intestinal worms. A large percentage of the hog remedies on the market put up by patent medicine firms contain medicinal agents which destroy intestinal worms, and it is to these properties that these remedies usually owe their curative value if they possess any. The way in which these remedies keep your animals from having cholera is by keeping them

free from intestinal worms and by keeping their digestive tract in good working condition.

Santonin and *calomel* are perhaps the two most valuable remedies that we possess for ridding hogs of intestinal worms. These two drugs should be given in doses of about 5 gr. of santonin and 8 gr. of calomel for each 100 pounds of live weight. The best plan of giving these two drugs is in powdered form, thoroughly mixed with the feed.

Giving Worm Medicine.—In giving calomel and santonin to a large drove of hogs it is usually a good idea to place all the animals in a large pen at night without any supper and allow them to come up the following morning good and hungry. Then, before any other food is given, give the ground feed in which the medicinal agents have been mixed. The most effective plan of giving worm medicine is to have your local veterinarian put you up some powders, each containing enough of the two drugs to dose, say, about five hogs. Mix this with a small amount of soaked ground corn or bran and place in the feed trough. Then let out five of the animals and let them eat up the contents of the trough. These animals should then be driven into another lot, and five more let out into the feed lot. By this means of dosing only a few animals at a time all the hogs get about an even amount of the drug, whereas, if the entire amount was mixed with the feed of the entire herd, there would be several of the less active animals which would not receive a sufficiently large amount of the drug to do them any good. Another important element in getting proper administration of this drug consists in thoroughly mixing it with the food before giving it.

Do not simply scatter it over the food after it has been placed in the trough, but thoroughly stir it up with the ground feed in a bucket or other vessel and see that it is most thoroughly scattered through the entire contents of the vessel. It is only by thus thoroughly mixing the drug with the food that good results can be accomplished.

Another remedy which is often used for the purpose of getting rid of intestinal parasites in hogs is *turpentine*. This remedy has the advantage of being cheap, and is usually convenient. It is especially useful in treatment of worms if the so-called "thorn-headed" worm, which is described in the section on Intestinal

Parasites, be present. The average dose of turpentine for the purpose of ridding the bowels of worms is about 1 teaspoonful for every 100 pounds of body weight. In giving this drug the most convenient method is by mixing it with milk. Turpentine and milk mix readily and form a perfect mixture, which the animals will usually take very readily. This remedy also is best given in the morning, after the animals have been starved over night. Turpentine is often not effective in a single dose of this size, and it is better to repeat the amount each morning for three days, and then, with the last dose, combine some good physic to sweep out the bowels and remove all the worms or other foreign material which may be present.

There are a number of other substances which are valuable for this same purpose, especially worthy of notice being *areca nut* and *worm seed*. However, in most cases the turpentine or the calomel and santonin will be found to be all that is necessary. These remedies can be secured through your regular veterinarian much cheaper than the patent so-called "hog remedies" and "hog-cholera cures," and will be found to be much more valuable.

Bronchitis or Winter Cough.—Another class of disease common in hogs during the winter months, and especially where they are improperly housed or allowed to burrow around or under straw stacks and manure piles, is winter cough. The principal symptom of this disease is the cough, which is especially pronounced when the animal comes from the overheated quarters under the straw pile in the morning out into the cool air. This condition, while not a serious one in itself, nevertheless interferes with the proper growth of the animal and makes it more susceptible to other diseases, and especially so to pneumonia and the lung form of hog-cholera.

Treatment for this condition consists principally in removal of the animals from their unhealthy sleeping quarters to sheds which are properly lighted and ventilated, and where the animals will have sufficient room to prevent overcrowding and piling up at night. Where the animals are somewhat run down from long-continued mistreatment small doses of some condition powder may be necessary. The following combination works very nicely in these cases:

Pulv. nux vomica	½ pound
Pulv. ginger	1 "
Pulv. sodium bicarbonate	1 "
Pulv. fenugreek	3 pounds

Give a teaspoonful to each 100 pounds of body weight once a day.

Quarantine of Infected Premises.—In the practice of human medicine it is always made the rule, when a contagious or catching disease is present in a house, to place upon that house a placard showing in large type the nature of the disease which is present, and warning every one not a member of the household to keep off the premises. This quarantine notice is kept posted until all evidence of the disease has disappeared in this household and the premises have been thoroughly disinfected. By such methods as these the practitioners of human medicine have remarkably cut down the spread of the contagious diseases among members of the human race, and we now do not see one case of measles, small-pox, scarlet fever, diphtheria, and other similar diseases where we formerly used to see dozens of them. The death-dealing plagues which used to sweep over the entire civilized world are no longer to be found in modern civilization, and many diseases which were terrors of former days are now entirely driven from our shores.

This same method of handling contagious diseases in the lower animals has been applied in the case of a few of the less widespread diseases, and the results have been good. So far we have driven several important contagious diseases from our country, notably, foot, and, mouth disease and contagious pleuropneumonia. If we are to really take up the matter of hog-cholera eradication in a serious manner, it will be absolutely necessary that we establish some system of quarantine regulation on the infected farms in order that spread of the infection may be cut down to the very lowest point.

So widespread has cholera become that it is indeed a big undertaking to attempt the establishment of a system of quarantine which will be at once effective and, at the same time, not ruin the swine industry of the country for several years. Yet bigger tasks than this have been accomplished in the past, and what man

has done man may do, so we must simply gird up our loins and buckle down to the task in real earnest.

About the first real systematic work along the line of hog-cholera eradication which was undertaken by our National Government was during the summer of 1913, when demonstration stations were established in Dallas County, Iowa; Pettis County, Missouri; and Montgomery County, Indiana. In each of these counties a survey of the county was first made, for the purpose of determining just about how many hogs there were in the district, how large a percentage of the animals were effected with cholera, and how many hogs had been lost during the previous year. Arrangements were then made for serum treatment of all infected herds, and simultaneous or serum treatment, as indicated, in adjoining herds for the purpose of preventing the spread of the infection.

In these counties there was but little difficulty in establishing an understanding along the line of treatment of infected and exposed herds, but there was a great deal of difficulty when it came to the matter of quarantine. Most of the owners did not want a quarantine established on their premises, and, furthermore, the state officials were in many instances somewhat backward in rendering assistance along this line. In these cases the difficulty with the state officials was not a lack of willingness to co-operate, but a fear of the effects which would follow if a storm of protest arose from the stock raisers over the establishment of quarantine on their premises. State veterinarians are, as a rule, political appointees, and it is not policy for them to take part in anything which may prove to be disagreeable to the stockmen of the state.

With proper understanding of the matter, however, no man should object to the establishment of quarantine on his premises when cholera exists on the farm. The disease is unquestionably contagious and catching to other animals, and everyone should at least have the good of his neighbor enough at heart to be willing to take any reasonable steps to prevent the spread of the disease to his herd. Further than this, the neighbor should have enough interest in his own herd to insist that such a method of warning be established as will enable him to avoid danger of carrying the disease to his own herd.

Among the states which have shown particular interest in the eradication of hog-cholera during the past year is that of Ohio. This state is very fortunate in having two of the most prominent advocates of the serum treatment of cholera in the United States associated with the state university in the persons of Doctors Fischer and Fitzgerald. As a result of the repeated recommendations of the state veterinarian in his annual reports, the General Assembly of the State of Ohio in April, 1913, took up the matter of hog-cholera eradication, and made an appropriation of $20,000 for use in the carrying out of an experimental investigation in the control and eradication of hog-cholera. As this amount of money would by no means be sufficient to carry on a state-wide experiment, the work was, of necessity, limited to a restricted area of the state.

Accordingly, arrangements were made to select a county in which cholera outbreaks were especially frequent in occurrence, and in which, at the same time, the support of the farmers and stockmen could be counted upon. After a thorough survey of the most frequently infected area it was decided to carry out this experiment in Fayette County. As an example of the interest displayed by the residents of this county, it is worthy of mention that a petition asking for the establishment of the experiment station in this county was presented to the State Board of Agriculture carrying the signatures of 3714 names out of a total of 5600 voters in the county.

This is the kind of support that must be given to this movement in every locality if the work is to be a success. Successful work along sanitary lines can only be accomplished when the state or Federal authorities charged with the carrying on of the work have the hearty support and co-operation of the residents of the district, and receive their confidence and intelligent support at every turn.

In the beginning of a great undertaking like this it is necessary that certain well-laid plans of campaign be formed, and then carried out to their successful completion. It was first necessary that the officials entering upon this work gain a thorough knowledge of just what conditions they had to deal with, and, accordingly, the first step in the campaign was a thorough investigation of the conditions which existed in the district in which the work was to be carried out. State inspectors were sent for this purpose into the

field, with instructions to visit every farm in Fayette County, and make a report on conditions which were found there. These reports were made out on the following form:

THE OHIO AGRICULTURAL COMMISSION

DR. PAUL FISCHER, *Chief.*
Bureau of Live Stock Industry.

HOG-CHOLERA CONTROL WORK IN FAYETTE COUNTY

FORM No. 1.
AUGUST 1, 1913.

JEFFERSON TOWNSHIP

SURVEY OF FARMS AND SWINE THEREON

Farm No.....Acres.....Section of Tp.....Road.....
Name of Owner.....Tenant.....
Address of above..... .....
No. of swine on premises this date, 1913. Total.....
Bred sows....Sows not bred.....Pigs.....Shoats.....Boars....
Breed.....Pure Breed.....Registered.....
Estimate No. of swine for April, 1914. Total.....
Bred sows....Sows not bred.....Pigs....Shoats.....Boars.....
Nature of soil.....
Stable conditions.....General conditions.....
Cholera on premises AT PRESENT?.....
Is owner using State Serum?.....Commercial Serum?.....
How much C. S. in past 12 mos.?.....Cost?.....
Results satisfactory?.....
Cholera present in 1913?.....1912?.....1911?.....1910?.....

How many swine lost from cholera
- 1913?.....Value?.....
- 1912?.....Value?.....
- 1911?.....Value?.....
- 1910?.....Value?.....

Are intestinal worms in evidence?.....
Is owner willing to co-operate with state in extermination work?....
.....
Has owner received and read a copy of Bulletin No. 10?.....
.....
Notes on unusual conditions.
.....
.....
.....
.....
.....
Inspector.

With this information before them the members of the State Live Stock Sanitary Commission were enabled to prepare maps showing the location of each herd of swine in the county, with the number of hogs on the premises. They were also able to locate on these maps the exact location of all infected farms, and outline a plan for controlling the disease in these infected areas and prevent its spread into new territory.

Quarantine Rules.—With a view to the prevention of introduction of new sources of infection from outside the county, and also to prevent scattering of the disease within the county, certain quarantine regulations were drawn up and put in force.

As a preliminary move, it was required that all public stock-yards in the county be disinfected. Driving or unloading of swine into these disinfected yards was then absolutely forbidden except by special permit. Such permits would be issued only in cases where the swine were free from disease and had not been exposed to the infection. Railroad companies owning these yards were also notified of the nature of these quarantine regulations applying to stock-yards, and a quarantine notice was prominently posted in all public stock-yards.

By this means it is hoped to free all public stock-yards from cholera infection and to keep them free from the same. From what we have already learned regarding the danger of these infected yards as a source of infection, and the examples of outbreaks arising from this source which we have seen, we can appreciate the great forward step that will have been accomplished when this has been thoroughly carried out.

Shipment of Swine Into County.—In order to prevent the carrying of cholera into the county from adjoining infected territory the bringing of any swine into Fayette County was absolutely forbidden, except under special permit. This permit was issued only for swine coming from localities that are known to be free from cholera infection, as shown by health certificates made out by properly authorized veterinary inspectors. All public highways along the county border, leading into or out of the county, were properly posted with the following warning notice, in order that anyone bringing swine over the line without permission might be

duly warned of the violation of law and the penalty which they would be liable to:

WARNING!-QUARANTINE LINE-DANGER!

THE MOVING, DRIVING OR HAULING OF SWINE

ACROSS THIS LINE INTO FAYETTE COUNTY IS

FORBIDDEN BY LAW

UNDER PENALTY OF FINE OF $50.00 TO $500.00! BY ORDER OF AGRICULTURAL COMMISSION OF OHIO
UNDER AUTHORITY OF SECTION 1195 GENERAL CODE OF OHIO.

A. P. SANDLES, PRES. AGR. COMMISSION OF OHIO. || DR. PAUL FISCHER, CHIEF BUREAU OF LIVE STOCK INDUSTRY.

READ INSTRUCTIONS AND INFORMATION BELOW!

THE LOSSES FROM HOG CHOLERA IN FAYETTE COUNTY RANGE FROM $60,000 TO $120,000 ANNUALLY
THE LOSSES FOR THE WHOLE STATE OF OHIO APPROXIMATE $3,000,000.00
THE 80TH GENERAL ASSEMBLY OF OHIO HAS APPROPRIATED $20,000
FOR THE EXPERIMENTAL ERADICATION OF HOG CHOLERA FROM FAYETTE COUNTY.
IF THIS WORK IS SUCCESSFUL IT WILL OPEN THE WAY FOR THE COMPLETE ERADICATION OF THE DISEASE IN OHIO.
THE OUTCOME OF THIS EXPERIMENT IS THEREFORE OF INTEREST TO EVERY CITIZEN OF THE STATE
TO MAKE SUCCESS POSSIBLE IT IS NECESSARY TO HAVE INTELLIGENT AND WILLING
CO-OPERATION OF EVERY CITIZEN OF FAYETTE AND ADJOINING COUNTIES.

BULLETIN No. 10 OF AGRICULTURAL COMMISSION DESCRIBES PLANS FOR ERADICATION.

EVERY CITIZEN OF FAYETTE & ADJOINING COUNTIES SHOULD READ THIS BULLETIN
IF YOU HAVE NOT BEEN SUPPLIED WITH A COPY FREE ADDRESS DR. PAUL FISCHER, CHIEF BUREAU OF LIVE STOCK INDUSTRY COLUMBUS, OHIO

OCTOBER 20TH 1913

During the early part of the United States Government demonstration work in Missouri, this was a point which a great deal of difficulty was experienced in handling. State officials seemed rather unwilling to establish a strict quarantine on shipment of swine into the county. This was in a large measure due to the fact that the state veterinarian at that time was about to retire from office, and did not wish to do anything which might in any way prove distasteful to the large stockmen of the state. As a result, we had several stockmen within the county who were a little unwilling to co-operate in the work any way, who were receiving repeated shipments of hogs from outside Pettis County, and many of which were from questionable sources. These hogs were frequently afterward divided up into smaller droves and sold for stocking purposes to farmers who had lost their swine from cholera the previous year.

With the coming into office of the new state veterinarian a more energetic campaign was outlined, and the good offices of the governor of the state enlisted in the campaign. As a result of this con-

ference, the following proclamation was issued from the offices of the Chief Executive of the state:

GOVERNOR'S PROCLAMATION

RELATIVE TO THE

SHIPMENT AND QUARANTINE OF HOGS

WHEREAS, the State Veterinarian in a communication under date September 22, 1913, submitted an official report to me which states that hog-cholera, a contagious and infectious disease, is prevalent and widespread among hogs in all counties of the State of Missouri, except Pettis, and

WHEREAS, on September 23, 1913, I called the State Board of Agriculture and the State Veterinary Surgeon to meet together in Sedalia, Missouri, for the purpose of arranging and adjusting such rules and regulations as they deem wise, and as safety demanded for the movement of hogs into Pettis County from the above-named localities, and

WHEREAS, in pursuance of said call, the State Board of Agriculture and the State Veterinarian met together in Sedalia, Missouri, on September 26, 1913, and, after due consideration of the said official report of the State Veterinarian, arranged and adjusted rules and regulations for the safe movement of hogs into Pettis county from the above-named localities where hog-cholera, a contagious and infectious disease, was found to exist, and

WHEREAS, on the 9th day of October, 1913, the said rules and regulations so adopted were by me approved.

NOW, THEREFORE, by authority in me vested by law, and in accordance with Section 718, R. S. 1909, I, ELLIOTT W. MAJOR, Governor of the State of Missouri, having approved the rules and regulations controlling the shipment into and the quarantine of hogs in Pettis County, do hereby schedule and quarantine against each and every other county in the State of Missouri, in which hogs are considered capable of carrying hog cholera, a contagious and infectious disease, and prohibit the movement into or the uhloading in Pettis County of any hogs from the other counties in the State of Missouri, except under the following rules and regulations adopted by the Board of Agriculture and the State Veterinarian on the 26th day of September, 1913.

RULES AND REGULATIONS

(1) Hogs brought from the quarantined area into Pettis County for immediate slaughter must be unloaded on the premises where they are to be slaughtered, or hauled by wagon to such premises, and slaughtered within forty-eight hours after arrival.

(2) Each lot of hogs shipped or moved in any manner into Pettis County for feeding, pasturing, or breeding purposes shall be accompanied by a certificate of health issued by a graduate veterinarian stating that they have been immunized against hog-cholera; Provided, that this rule shall not apply to hogs intended for exhibition at the Missouri State Fair at Sedalia, Missouri.

(3) All certificates of health made in compliance with these rules shall be made in triplicate; one copy of which shall be sent to the State Veterinarian at Columbia, Missouri, one to the United States Inspector in charge, Sedalia, Missouri, and one to accompany the hogs.

(4) Whenever it is found that any hogs have been brought into Pettis County not in compliance with these rules, it shall be the duty of the State Veterinarian to place such hogs in quarantine, and hold same in isolation until twenty-one days after they shall have been immunized against hog-cholera at the owners' expense.

(5) All cars carrying hogs or cattle into Pettis County for feeding, pasturing, or breeding purposes shall be cleaned, washed, and disinfected before the stock is loaded.

IN TESTIMONY WHEREOF, I hereunto set my hand and cause to be affixed the Great Seal of the State of Missouri.

Done at Jefferson City, this 9th day of October, the year of our Lord, 1913.

[SEAL] ELLIOTT W. MAJOR.

By the Governor:

CORNELIUS ROACH,

Secretary of State.

These regulations are adopted by authority of Section 718, R. S. 1909.

Section 719 provides a penalty for violations of the same by a fine of not less than Fifty Dollars nor more than Five Hundred Dollars, or imprisonment for not less than one month nor more than one year for each and every offence.

Sheriffs and constables in Missouri are hereby directed to enforce these regulations and to arrest any and all persons who may be guilty of violation thereof.

Shipment of Hogs Out of Country.—No hogs could be shipped out of Fayette County except under properly authorized permit. No hogs could be taken to or unloaded in public stock-yards unless they were certified to as free from disease, and cars brought into the county for the purpose of shipment of swine must first be disinfected. This did not interfere with the shipment of healthy swine out of the county, except that there was a little inconvenience in securing necessary shipping permit. Railroad companies are aiding in the enforcement of this regulation by requiring that all animals loaded in Fayette County be accompanied by necessary certificates.

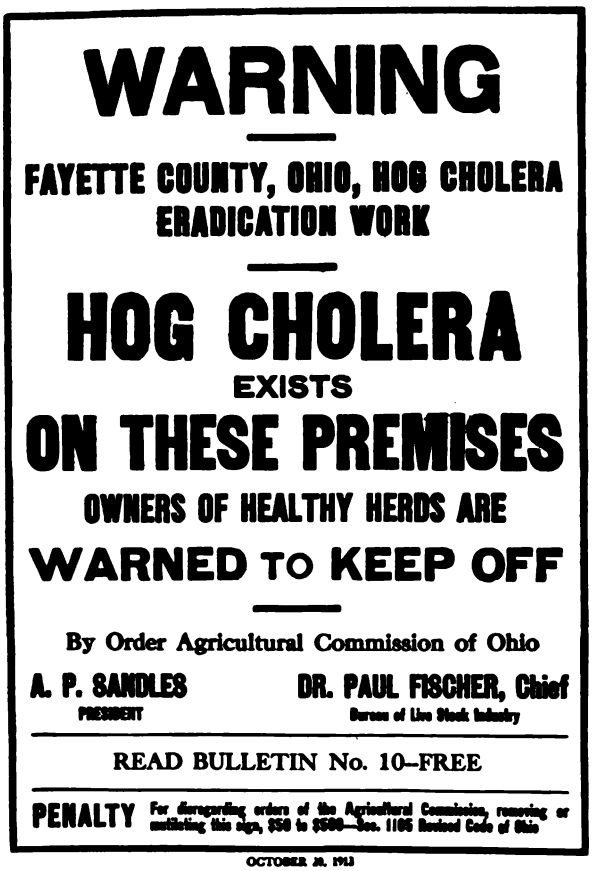
The shipment of infected or exposed animals out of the county, or their movement from farm to farm within the county, is absolutely forbidden. This is a step in advance of the quarantine

measures usually established in connection with hog-cholera. It is the usual custom where cholera makes its appearance in a neighborhood to allow the shipment of all animals which do not show any signs of the disease, provided they are moved to the shipping point under proper precautions, to avoid spreading of the infection. There is some question as to whether or not this should be permitted, and from the scientific standpoint, at least, the Ohio regulations are to be praised. From the practical side it may have a somewhat different light, and in any great movement of this kind, where general public co-operation is desired, it is necessary that we combine the practical with the theoretic.

However, as in these cases the exposed herds were at once treated by serum alone or the serum-simultaneous method, free of expense to the farmer, it is only reasonable that a strict quarantine be required. Such quarantine should be established provided the officials in charge of the work are sufficiently supplied with serum, and have a sufficiently large working force to handle these exposed herds promptly, otherwise it would be an injustice to quarantine an exposed herd and forbid shipment during the incubation period, as this would cause unnecessary loss. This is a measure which must be worked out in each locality, and adjusted to best fit the local conditions which exist in that particular state or locality.

Placarding of Premises.—Two forms of placards are used in Fayette County for farms on which swine are kept. One form is used for the purpose of quarantine notice in the case of farms which contain infected or exposed herds. The term "exposed," as used in this connection, applies to any herd kept on a farm adjoining one on which cholera is present, and in which the two herds are less than a half-mile distant. This quarantine notice, which is reproduced on p. 292, is printed on yellow metal sheets, 10 by 14 inches in size, and is tacked up at the gateway entrances to these farms from the public roadway.

This notice served to warn anyone who was about to come upon the premises that hog-cholera was present thereon, and of the danger to their own herds which would result from their entering this farm. Enforcement of this warning is provided for by a suitable penalty, which will serve to stop any who might otherwise be inclined to disregard the warning.


WARNING

FAYETTE COUNTY, OHIO, HOG CHOLERA ERADICATION WORK

HOG CHOLERA
EXISTS
ON THESE PREMISES

OWNERS OF HEALTHY HERDS ARE
WARNED TO KEEP OFF

By Order Agricultural Commission of Ohio

A. P. SANDLES
PRESIDENT

DR. PAUL FISCHER, Chief
Bureau of Live Stock Industry

READ BULLETIN No. 10—FREE

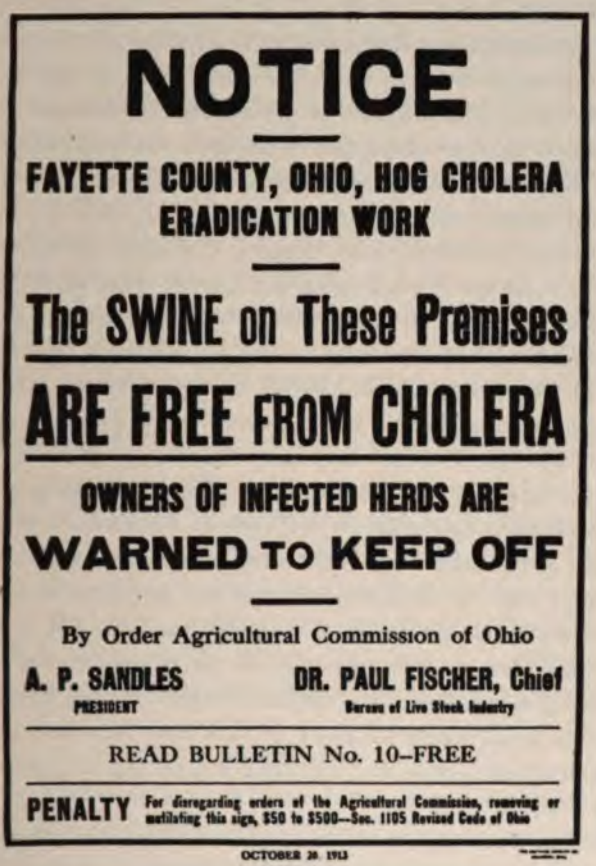
PENALTY For disregarding orders of the Agricultural Commission, removing or mutilating this sign, $50 to $500—Sec. 1105 Revised Code of Ohio

OCTOBER 20, 1913

This is in line with the practice in human medicine of placarding premises on which infectious and contagious diseases may exist, and warning the public to keep off these infected premises. This is a big step in the proper direction, and will do a great amount of good in preventing the rapid spread of cholera throughout a neighborhood.

The second form of notice used in Fayette County is for the protection of the owners of the farms where no cholera exists from anyone coming upon their premises who comes from an infected farm. This notice is distinguished from the warning placard, above shown, in that it is printed on white background instead of yellow. This notice serves as warning to owners of infected herds, and also

to traveling hog buyers and others who may come from an infected feed lot, to keep off these premises.


NOTICE

FAYETTE COUNTY, OHIO, HOG CHOLERA ERADICATION WORK

The SWINE on These Premises

ARE FREE FROM CHOLERA

OWNERS OF INFECTED HERDS ARE

WARNED TO KEEP OFF

By Order Agricultural Commission of Ohio

A. P. SANDLES
PRESIDENT

DR. PAUL FISCHER, Chief
Bureau of Live Stock Industry

READ BULLETIN No. 10–FREE

PENALTY For disregarding orders of the Agricultural Commission, removing or mutilating this sign, $50 to $500—Sec. 1105 Revised Code of Ohio

OCTOBER 20, 1913

Through these measures further introduction of cholera into Fayette County from sources outside the county will be checked, and, by proper treatment and quarantine of all infected herds and exposed animals, it will be possible in the course of two or three years to entirely eradicate the disease from this county. The average yearly losses from cholera in this one county of Ohio have been estimated at $120,000, so that, if by the expenditure of $20,000 per year for three years the state officials are enabled to stop these losses, there can be no question that it is money well invested. This demonstration, while at this time benefiting only

the one county of the state, will be an excellent example of what can be done, and will, if successful, lead to a statewide campaign with the same object in view.

Use of Hog-cholera Remedies.—As a means of preventing hog-cholera a large number of patent medicines are on the market, many of which claim to be capable of preventing the disease. Most of these compounds are absolutely worthless. A considerable number of them do possess some value, in that they contain certain medicinal agents which remove intestinal parasites from the animal and at the same time improve digestion and act as a general tonic. As far as containing any special drug which acts as a direct prevention to the development of cholera, there is no such remedy as yet discovered.

Of all the drugs which have been experimented with in the prevention of hog-cholera, there are two which probably are more effective in this direction than any other remedies. These two agents are hyposulphite of sodium and black antimony. Officials of the Dominion Government, with whom I associated while in the Province of Ontario, were quite firm in the opinion that they had seen some very excellent results from the use of these two drugs, both as a preventive and in a curative manner. It is not very likely that these agents, either singly or in combination, possess any great power as curative remedies for this disease, but that they do possess great power for good, in that they tend to regulate the condition of the bowels and maintain a good digestive action, cannot be denied.

Several years ago the following formula was devised by Dr. D. E. Salmon, of the United States Bureau of Animal Industry, and has since been quite extensively used:

Wood charcoal	1 pound.
Sulphur	1 "
Sodium chlorid	2 pounds.
Sodium bicarbonate	2 "
Sodium hyposulphite	2 "
Sodium sulphate	1 pound.
Antimony sulphid	1 "

This is all mixed together in the form of a powder, and should be given to hogs in the dose of a tablespoonful to each 200 pounds

of live weight. It is best given thoroughly mixed with the food, and should not be given oftener than once a day.

The results from the use of this remedy have been found to be very good in a number of instances. Sick animals which entirely refuse food will often show a marked improvement in appetite and general condition after one or two doses of this compound. However, it is by no means a curative remedy, and cannot be depended upon to produce any remarkable results. However, in case of an outbreak it is worthy of trial, but should not be used to the exclusion of serum. As far as that goes, serum is by no means to be considered as a curative of cholera, but is more of a preventive. Some cases have apparently recovered after the giving of serum, especially if it was given early, but even the most enthusiastic advocates of the serum treatment do not claim for it any great curative powers.

As a preventive treatment this combination of hyposulphite of sodium with black antimony cannot be regarded as nearly so effective as the serum immunization, but it is, nevertheless, an excellent condition powder, and will do a great deal to keep your animals in a condition to resist an attack of cholera or any other infection. We must not think, however, that by the administration of such a remedy as this we can relax our efforts in every other direction and disregard all the laws of sanitation and quarantine.

SUMMARY

Briefly summing up the preventive measures which are of value in checking the outbreaks of hog-cholera, we find the following important facts to be worthy of our serious consideration:

(1) *Breed.*—It is a false idea that certain breeds of hogs have any definite immunity to cholera. One breed is as likely to take cholera as another. Avoid too close inbreeding, as this lowers the strength of the animals. Do not place confidence in any single breed as being secure against attack by cholera. If you do, you are bound to be disappointed.

(2) *Feed lots* must be kept in a sanitary condition if we are to keep the herd free from cholera. Do not allow the presence of any old, dirty mud-holes for use as hog wallows. Provide a clean, dry place for feeding, and do not make it necessary for the ani-

mals to swallow a large amount of their own manure in order to get a square meal of corn.

Have your feed lots so located that they drain easily, and also have them so situated that they are not crossed by any running stream of water.

Avoid placing hogs in a pasture or feed lot that lies close to a public road. Also have your feed lots so fenced that it will not be possible for your animals to get out and wander over into some one's else feed lot or for some strange animals to enter your lots.

(3) *Sleeping Quarters.*—Provide light, dry, airy, and well-ventilated sleeping quarters for your hogs. Have them roomy enough that overcrowding will be unnecessary, and provide sufficient window space to allow of the free entrance of sunshine and air. Remember always that pure air and sunshine are the two best germ killers that we possess.

Do not, under any conditions, allow your hogs to burrow under straw piles and manure heaps, nor have sheds covered over with straw stacks and manure. This always leads to overheating, suffocation, and diseases of the lungs and throat.

(4) *Water-supply.*—Be just as particular about the purity of the water-supply for your animals as you would be for your household. Remember that impure water is just as capable of producing disease in animals as it is in man. This is especially true in reference to cholera, as it has been clearly demonstrated that cholera can be transferred from one farm to another through the agency of impure water, and especially by running streams.

Provide sanitary drinking troughs for your hogs, and do not require them to secure their water-supply out of an old, dirty, filthy trough which is filled with dirt and germs.

Remember the many dangers which threaten human lives as well as the lives of your animals if you have an impure water-supply on your farm. Typhoid, measles, diphtheria, and many other diseases are often transmitted indirectly through water or milk.

(5) *Food-supply.*—Here also you must exercise the same degree of cleanliness which you would use in reference to your own table if you expect your animals to do well. Hogs must not be made the scavengers of the farm. Do not make a practice of feeding

hogs on decomposed and souring food which no other animals would eat.

Especially make an attempt to keep your swill barrels, slop buckets, etc., reasonably clean. To do this means a great advance in the prevention of the stomach and bowel diseases which so often lead to the breaking out of cholera.

Make it an especial point never to feed dead animal carcasses to your hogs, and especially never to feed the dead carcass of another hog. This is, of course, doubly important if the animal died of, or may possibly have died of, cholera. The only safe rule, however, is never to allow swine to feed upon a dead animal carcass of any kind.

Feeding of swill and garbage from city homes, restaurants, hotels, grocery stores, etc., is to be strictly forbidden if you wish to avoid an outbreak of cholera in your herds. Remember, some of the most severe outbreaks of cholera ever seen have followed this practice. Scraps of diseased pork very often find their way to the hog's stomach in this way, and this will never fail to result in the development of hog-cholera in the unfortunate animal and an enormous money loss to the foolish owner. Feed only clean, healthy food, and you will be many times repaid for the slightly greater cost.

(6) *Proper Variety of Food.*—Hogs, as well as man and other animals, require a certain amount of variety in their food-supply. This is absolutely necessary if their digestive apparatus is to be kept working properly. Do not feed your hogs on a strictly corn diet and expect them to do well. Give a little variety, and in making a change from one class of food to another do so gradually. For instance, when starting to feed green corn in the fall make the start slowly. Otherwise you will upset the digestion and pave the way for cholera.

(7) *Sunlight and Air.*—Do not crowd your hogs into close, damp, dark quarters, where they do not have sufficient sunlight and fresh air. These two natural agencies are just as necessary for the proper development and growth of a healthy hog as they are for a healthy child. You know how quickly a child will become pale and lose energy and strength when confined in dark, poorly ventilated rooms. This sort of unhealthy management has a like effect upon the hog.

Fresh air and good, pure sunlight are two of the cheapest tonics in the world, and yet we find many who prefer to spend their money for useless patent medicine dopes, while this highly beneficial tonic provided by nature is left neglected, and even, in fact, shut out both from our own homes and the quarters occupied by our animals as well.

(8) *Disposal of Dead Bodies.*—Do not fail to appreciate the great amount of danger which surrounds improper disposal of the bodies of dead animals. There are only two proper methods of disposing of a dead animal carcass of any kind. One is by deep burial, the other by burning. Of these two, the last is by far the easier and the more effective. Thorough burning can be quickly done if properly carried out, and not only destroys the carcass, but also destroys for all time the disease-producing germs which caused its death.

Remember the great danger which follows the exposure to the attacks of buzzards and carrion crows of dead animal bodies of any kind. Get it firmly in mind that buzzards practically always mean cholera, and do not permit anything to be exposed which will be likely to attract these disease-carrying birds to your premises.

Again, let us call to mind the great amount of harm that can be done by allowing healthy hogs to feed upon the carcass of an animal which has died from disease. This danger is, of course, increased a hundredfold if the dead carcass be that of a hog which has died of cholera.

(9) *The Buzzard.*—Remember that this bird is practically always the forerunner of disease, and especially is he noteworthy as a means of spreading cholera infection. Laws protecting the buzzard should in most instances be repealed. Until such measures are taken the next best method of meeting this danger is to offer no inducement for the buzzard to visit your premises. Promptly burn all dead animals on your premises and insist upon your neighbor doing the same. Carelessness upon the part of one individual in this respect will endanger the health of the animals of every farmer in the community.

(10) *Infected Stock-yards.*—Remember that almost every public stock-yard in the United States is infected with hog-cholera.

Never purchase hogs from an infected public stock-yard and take them home to place in your own feed lots. Also, never allow hogs being shipped in by you for feeding or breeding purposes to be unloaded in a public stock-yard pen for feeding and watering. To do so means infection in a large percentage of cases.

Do not overlook the fact that hog-cholera infection can be carried from an infected stock-yard pen to your own feed lots by other animals as well as hogs. Cattle and sheep are also capable of scattering the infectious material from one part of the country to another by carrying infectious manure, litter, and mud upon their hoofs.

Insist on a thorough disinfection of all public stock-yards, or at least the keeping separate of free and quarantine pens. Thorough disinfection should follow the passage of any shipment of hogs through these pens, and especially so if they are cholera-infected or exposed herds. Proper provision should be made for this by Act of the State General Assemblies, and it is your duty as a tax-payer to see that your legislators give attention to this point of protection upon the part of the railroads and other common carriers.

(11) *Infected Stock Cars.*—We have found that a herd of cholera-infected animals are capable of infecting the lots in which they are kept, and also that they are capable of leaving enough disease-producing material in the railroad cars in which they are shipped to cause an outbreak of cholera in the next herd of hogs that is loaded into these cars for shipment. To avoid disease you must insist when you are shipping hogs to your feed lots for feeding or breeding purposes that the cars in which they are loaded be free from disease germs.

This can only be assured by a thorough cleaning and disinfection of the cars after each time they are used for the shipment of swine. When you are making shipments of this kind absolutely insist that you receive a car which has been properly cleaned and disinfected, if possible, under supervision of a United States Bureau of Animal Industry official.

Remember that the danger from these cholera-infected cars is not by any means limited to the shipment of hogs in them, but also applies to the shipment of any other class of animals, such

as sheep or cattle. These animals, through shipment in infected cars, may gather up enough disease-producing germs on their hoofs to be the cause of a cholera outbreak on your premises.

(12) *Transportation of Hogs.*—In the removal of infected and exposed animals to market along public highways every precaution must be taken to protect the health and safety of other herds which may be located along the route of travel. Such shipment, if allowed at all, should only be allowed in tight wagon beds, and under no consideration in the open crate-like beds which allow of the free scattering of the infection along the roadway.

(13) *Worthless Dogs.*—Do not keep any worthless tramp dogs on your farm, and do not permit the trespassing on your farm of such animals owned by your neighbor. Warn the owner that the animal must be kept at home, and, if he fails to comply, shoot or otherwise destroy the animal if again found in your feed lots. These tramp dogs are very often carriers of cholera infection, especially in those neighborhoods where the dead animals are disposed of by burial, and they do not possess any value as compared with the great amount of harm which they may cause.

(14) *Chickens* and *pigeons* should not be allowed to travel about from one feed lot to another. In the case of chickens, it is a very easy matter to control their range, but in the case of pigeons it is often a difficult proposition. Yet, in cases where they seem to be dangerous as a possible source of spread of the disease, they should, if necessary, either be penned up or destroyed. Their flights can usually be controlled either by clipping or tying up of the wings. This can be so done as to prevent any very long flights, and yet allow enough motion to enable them to get to and from their nests.

(15) *Traveling Hog Buyers and Butchers.*—Absolutely insist that these men keep out of your feed lots. You can never tell when they have come from an infected feed lot, and, as a matter of fact, they often do not know it themselves, as they may enter a feed lot in which cholera is just getting a start and in which the disease is not yet plainly to be seen. You can show your animals just as well by having the buyer remain outside while you drive the animals up along the fence, where they can be seen without exposing your pens to the dangers of infection.

Remember that you also may be the cause of carrying infection into your feed lots, and never leave a strange hog lot and go directly to your own without first thoroughly washing all mud, manure, and other dirt off your shoes, preferably with some good disinfectant solution, such as liquor cresolis compound.

(16) *Bringing In New Hogs.*—This must always be regarded as a dangerous undertaking. We can never be sure that the new animals so brought in are free from cholera unless we have positive knowledge that they have been properly immunized by the double serum virus method of treatment. Even animals which have passed through an attack of the disease are not always safe to add to our herds, as they may still have a hidden type of the infection—in other words, they may belong to the class of what we know as "cholera carriers."

The only real certain means of preventing entrance of cholera by this means is the establishment of a proper quarantine on the animals for at least thirty days after their arrival on your premises before adding them to your regular herd. We know that the incubation period of cholera is usually less than two weeks, and very seldom as long as four weeks, so that by quarantine for a period of thirty days we have insured our herd against all danger from this direction.

On shipments of any class of animals which may come into the United States from abroad the United States Government requires quarantine at port of entry for a reasonable length of time. By this means introduction of many severe animal diseases which are present in foreign countries has been prevented, notably so an outbreak of surra, which came very near being admitted into the country in 1906 with an importation of sacred cattle from India. These animals had been thoroughly tested for presence of the disease before the shipment from India, and had been declared free from infection. However, while in quarantine at New York harbor it was found that several of the animals were really carriers of surra infection, and only by prompt measures was the introduction of this disease into the United States prevented.

Home quarantine of newly purchased animals can be very easily and very cheaply carried out, and it is a most important safeguard against severe losses in your herd.

(17) *Disinfection of Pens.*—All pens in which cholera-infected animals have been kept should be most carefully cleaned and disinfected after the animals have been removed or the disease has run its course. This cleaning-up process should include raking up of all cobs, loose boards, old litter, manure, etc., and destroying same by burning. Then the pens should be thoroughly sprinkled with chlorid of lime and some good germ-destroying solution sprayed over them, such as liquor cresolis compound. Following this, give sunlight and fresh air a good chance at them. By this means the lots can be entirely rid of disease germs within a period of six months; otherwise they remain dangerous for a year or more.

In this cleaning-up process it is especially necessary that we clean up all dirty corners, remove any tumble-down hog sheds, and drain out and disinfect any insanitary hog wallows.

(18) *Exhibiting at Fairs.*—We must always bear in mind the dangers which go with the showing of animals at public fairs and exhibits, where they are brought in contact with animals from all parts of the country, many of which may have traveled in infected cars or been exposed in other ways to danger of infection on the way to the exhibit. The larger the exhibition, of course, the greater the danger.

The only safe methods by which we can meet this danger is to either have all animals intended for exhibition purposes properly immunized by serum-simultaneous treatment while young, or else quarantine on our own premises for a period of thirty days all animals used for exhibition purposes as soon as they return home. If we keep the show animals separate for thirty days after their return from the fair they will have opportunity to develop the disease, if they have by any chance become infected, and we will thus be able to prevent the entrance of the disease into the entire herd. The outbreak of the disease among the show animals will, of course, mean a considerable loss if it should occur, but it will be less severe than if the entire herd had become infected. The better way, of course, is to immunize the animals before sending them to any exhibition of this kind. By this practice we avoid all loss and remove the necessity for quarantine.

(19) *Destruction of Stunted Animals.*—Usually after an outbreak of cholera in a herd there will remain one or two animals at

the end of the outbreak who have had a severe attack of the disease, but have not died. These animals are frequently gaunted up, have a chronic cough, and develop into chronic runts. It is often a question what to do with these animals. While the loss may have already been so severe that the owner feels as if he ought to try and save these animals if possible, yet it will usually be found the better policy to get rid of them by knocking them in the head. They seldom do any good, and usually remain runts as long as they live. Not only this, but it appears quite probable that in many instances these cases continue to scatter germs over the premises and sow the seeds for another outbreak in the young shoats of the following year, or in any new animals that may be added to the herd during the winter.

(20) *New Cattle and Sheep.*—These animals, as well as newly bought swine, are capable of bringing hog-cholera infection upon the farm in sufficient amount to cause an outbreak of the disease if the cattle are placed in the same feed lot and pastures with the hogs, as is usually done. This is especially liable to happen if the cattle are purchased in a district where cholera is present, or if they be shipped in infected cars, or brought through infected public stock-yards. A great amount of care is necessary in this connection or we will have an outbreak of cholera in the herds which we are at a loss to explain. Always remember that other animals are just as capable of carrying the disease-producing germs as are the hogs themselves, and that once the infectious material gets into a feed lot it will not be long in causing signs of sickness.

(21) *Infected Public Roads.*—In the Central Western States, where the greatest number of our hogs are raised, and where hog-cholera is seen in its most severe form, a majority, perhaps, of the public highways have been infected by midsummer of each year from the passage over them of diseased swine or of wagons carrying sick or exposed animals to market. Just where this infection is present, and where it is absent, it is impossible to tell. Accordingly, the only safe plan is to keep your hogs entirely off of the public road. Never allow them to forage along the public highway. To do so is to invite an outbreak of cholera in your herd.

It is also a very good plan to have your hog lots just as far as possible removed from the public roadway. In this way you will

avoid many dangers, such as infected dust, stray hogs, and hog buyers and butchers.

(22) *Stray hogs* are always dangerous animals to deal with. These animals have been traveling along the public highways, perhaps for several days, and are almost certain to have come in contact with the germs of the disease during their journey. As a result, they soon develop hog-cholera after entrance to your premises, and the result is a rapid spread of the disease among your own herd and severe losses.

In case a stray hog comes upon your premises, either immediately drive him away or else place him in a separate pen far removed from the animals of your own herd, and hold for at least thirty days awaiting an owner or the development of any infectious disease to which he may have been exposed. At the end of thirty days, if the owner cannot be found and the animal has shown no symptoms of disease, he may be safely added to your herd.

(23) *Interchange of Boars.*—Exchange of boars from one premises to another is a dangerous practice. It is far better to own your own boar. In this way you have the animal when you want him, and you are not running the risk of infection being carried to your feed lots from that of a neighbor.

Shipment of sows to a distant breeding farm for the purpose of breeding is also a dangerous practice. In this manner there is not only the danger of picking up infection on the breeding farm, but there is also the added danger of the sows coming in contact with the infection on the road, either through infected cars or by passing through infected stock-yards. In those cases where the animals are sent by express the opportunity for infection in transit is decidedly less.

All sows that are thus sent away for breeding should be kept in quarantine pens for at least thirty days after their return home the same as advised in connection with animals which are e hibited at fairs.

(24) *Exchange of Farm Work.*—Exchange of work between far is a custom that is to be encouraged, but, at the same time, must observe a few necessary precautions to avoid danger of ca ing cholera to your own farm from some premises where the dis is present. It is a wise rule always to thoroughly scrub your

or boots before leaving another man's farm, and especially so if you have been in his feed lots. In like manner, if you have cholera on your own premises and are working with a threshing crew, you should thoroughly clean your shoes before leaving your own farm in the mornings in order to prevent the carrying of infection to other farms. Remember that you carry the infection to other farms as well as to your own, and you should have the best interests of your neighbor at heart as well as your own.

It is an excellent rule never to allow strangers in your own feed lots, and also not to trespass yourself in any neighbor's feed lot. Especially is this an excellent rule to adopt if cholera be present in the neighborhood.

(25) *Predisposing Diseases.*—Always remember that a healthy hog is far better able to resist infection by cholera or any other disease than a hog which has already been weakened by some previous disease, such as a chronic indigestion, intestinal worms, or an untreated cough. Do not neglect these apparently insignificant diseases of your herd. Keep the bowels active, the intestines free from worms, and the breathing apparatus in good condition. These little points of attention will often enable your herd to pass through an outbreak without in any way suffering, where otherwise you might have lost the entire herd had cholera found the animals weakened by disease and open to attack.

(26) *Hog Wallows.*—Never allow an unclean hog wallow in your feed lots. Either have a clean, sanitary place for this purpose or none at all. These mud-hole wallows are disease breeders and should not be allowed under any consideration. Construct a cheap, sanitary, concrete hog wallow that can be easily disinfected and which will serve as a clean, healthy bathing place for the animals.

(27) *Hauling Cholera Hogs.*—When you are for any reason engaged in the hauling to market of sick cholera hogs, or exposed animals, either for yourself or a neighbor, do not forget the importance of immediately cleaning out and disinfecting the wagon in which the animals are handled. All infected bedding, manure, etc., is to be immediately burned.

(28) *Dead Hog Buyers.*—Never allow a man engaged in the business of buying dead cholera hogs to enter your premises. By

all means never allow such a person to enter your feed lots. It should be forbidden by law to haul dead cholera hogs along the public highway. Such work spreads the disease over miles of territory that might otherwise have escaped the disease.

(29) *Divided Hog Lots.*—It would seem an excellent practice where large herds of hogs are kept to make some division of the herd into smaller lots, keeping them separated from each other by a considerable space. This means a little extra expense, and makes the work of caring for them a little more labor, but it would seem to be money well spent, as by so doing we are frequently able to cut the losses from cholera down to a small fraction of what they would be in case the entire herd was in one feed lot when cholera broke out among them.

In using separate feed lots, however, it must be remembered that should cholera break out in one pen, you can very easily carry it from this pen to another on your boots or shoes if you travel from the infected pens to a healthy pen in feeding. In such cases as this always feed the animals in the healthy pens first, and make the visit to the infected pen last. It is well to have a pair of rubber boots for use in the infected pens, and these can be afterward thoroughly cleaned with a strong disinfectant solution, such as liquor cresolis compound.

(30) *Running Streams.*—Always remember that the running stream is a constant source of danger, not only to your hogs, but to other animals as well. Running streams which pass through your pastures also pass through many other pastures higher up in their course, and receive drainage from many infected lots during an outbreak of cholera. If you have such a stream running through your pastures it is almost certain to carry cholera to your herd sooner or later.

(31) *Hog-cholera Medicines.*—Most of these preparations are a fake pure and simple. Few if any of them have any real value. What good they possess, if any, is due to the tonic action which they exert upon the digestive tract. A few of them do contain agents which aid in getting rid of worms and in this way assist in keeping up the health of the animal.

The recipe given, containing hyposulphite of sodium, black antimony, charcoal, and sodium sulphate, is perhaps as well

balanced a mixture as could be gotten up. Remember that this preparation is not curative for cholera, and neither is it preventive in the sense that by its use you can neglect every sanitary precaution. However, its use in combination with the use of common sense in regard to feeding, housing, and other possible sources of infection will very much improve the chances of the herd passing through an outbreak of cholera without taking the disease.

(32) *Quarantine Measures.*—Establishment of a reasonable quarantine is absolutely necessary if any scientific effort is to be made toward eradication of the disease in America. In no other way can we hope to check the spread of the disease. It is by establishment of quarantine measures that success has crowned the efforts of the medical profession in eradication of acute infectious disease outbreaks in the human family, and the same principles are equally sound in veterinary practice.

In order to make quarantine regulations of any lasting benefit it is absolutely necessary what we have the support of the entire community in their passage and enforcement. We must each and everyone of us be ready to obey the laws providing for quarantine which may be enacted, and we must make it our duty to see that our neighbor also obeys these laws.

It is only by such regulations as have been put in force in Fayette County, Ohio, and Pettis County, Mo., that we will be able to cope successfully with cholera, and not only prevent its further spread, but also in time completely eradicate the disease, and put the swine industry back on a firm financial footing. It will mean a little inconvenience and a little self-sacrifice at first for a few, but the end to be gained is well worth the effort. Let every man put the welfare of the entire community above his own personal convenience, and be willing to strictly obey all the provisions of the quarantine laws if his premises become infected. In like manner, let every man consider it his duty to see that his neighbor is equally conscientious in the performance of his duty. In every community there will be found one or two who will have to be forcibly impressed with the necessity of obeying the law. These stubborn cases will, through their own fault, sometimes have to be made an example of, and, where necessary, the police powers of

the state should be invoked and fines imposed where occasion demands.

Until a very short time ago the measures just mentioned were the only weapons with which we had been armed in our fight against cholera. Unquestionably, these sanitary measures have been very much neglected, as otherwise the disease would never have been able to gain the firm foothold that it now has in all parts of the United States. In the early days of the appearance of cholera down in the Ohio River Valley, if an energetic campaign against the disease had been carried on, hog-cholera could have easily been entirely wiped out within a very short time.

It is a sad page in the history of the hog-raising industry of the United States that the enormous danger which threatened was not recognized at that time, and as a result, no systematic effort at stamping out of the disease was made. Spreading with the speed of a prairie fire, as is always the case when a disease of this nature is introduced into new lands, cholera soon became firmly implanted upon American soil, and is now scattered from one end of the hog-raising belt to the other. Every year has seen more numerous and more severe outbreaks of the disease, and the severity of the outbreaks does not seem to decrease in the least. As a result the disease has become, indeed, a thing of terror to the hog raisers of the country, and large numbers have been entirely forced out of the hog-producing industry just on account of the fear they have of an outbreak of this disease about midsummer in their herds. At this time the animals usually represent a considerable investment in grain and pasture consumed, and are not in a condition to market with any profit. On this account the loss at this season of the year totals up into enormous figures.

Not only has this disease stricken terror into the hog-producing industry, but also indirectly it has been the means of greatly reducing the cattle production of the country. Not that the disease is transmissible to cattle, but in our Central States, where cattle are fattened largely upon corn, they cannot be profitably handled unless a drove of hogs are fed at the same time in order to get the greatest possible returns for the grain consumed, a large portion of which passes through the intestines of the cattle without being made use of as food. The great danger of severe outbreaks of cholera

among these hogs has scared many feeders out of the hog-producing business, and these same men, when deprived of the hogs, do not find the cattle industry profitable enough to repay them for the extra labor involved in handling them, and, as a result, the feed lots have been entirely abandoned in many instances and the ground given over to grain production.

As a result of these conditions we find that the United States is rapidly coming face to face with a serious situation in regard to meat supply. This fact is already being recognized by the large firms engaged in the meat business, and is the subject of much serious consideration on the part of the large packers. If present conditions are not changed within the next ten years we will be, indeed, face to face with a severe meat shortage. It is a problem that is of vital importance not only to the farmer and stockman, but also to the city dweller as well. In point of actual fact the question is a much more anxious one from the standpoint of the residents of our cities than it is for the farmer and stockman. The farmer can very easily get along without engaging in the raising of live stock to any very large extent. Grazing lands can be very profitably used for production of the various forms of grain, and the profit is practically as large and much more certain than that to be realized by turning of these same lands into feed lots for cattle and hogs.

From the standpoint of the city man the question has an entirely different meaning. The modern American laboring man is a heavy meat eater, and without meat he feels unable to perform his usual work. We consume more meat per capita in the United States than in any other of the modern civilized nations. This habit of enormous meat consumption is quite firmly fixed with the majority of us, and very few, indeed, would care to become vegetarians. Yet this important article of diet is threatening to become such an expensive luxury that the average laborer will be unable to afford it, if, indeed, such is not already the case.

Even within the past ten years the prices of meat have advanced in many cases over 100 per cent. In the case of pork products this is especially true. Pork chops, which ten years ago could be bought 3 pounds for 25 cents, now sell for 22 to 25 cents for a single pound. Other meats have advanced accordingly.

Beef roasts, which were formerly regarded as expensive at 8 cents a pound, now sell for between 20 and 25 cents per pound. In every other line of meat foods and meat-food products the tendency has been steadily upward, and it must continue so unless some way can be devised to check the ever-increasing shortage in meat production. The demand is constantly on the increase with our steady gain in population, and, if the supply continues to steadily decrease, there can only be one final outcome, and that will be an acute meat shortage. Prices must, of necessity, advance even still further, and it is only a question of time until meat will be forced off of the daily table of the ordinary laboring man.

One of the most important questions of the time at the present day is the high cost of living. Trusts are being dissolved, tariffs are being reduced, and in every direction the most supreme efforts are being made to reduce, in so far as possible, the high cost of living. We have here before us an example of one of the most important factors in the increase of costs of meats in the past ten years. With constantly decreasing supply, and a rapidly increasing demand in the shape of increased population, the course cannot be otherwise than upward.

This makes the problem one of very great national importance. It is a question that every citizen must, of necessity, be interested in. Hog-cholera must be wiped out. We have now in our possession an added weapon for use against this disease, and the aid of every man in the United States must be enlisted to assist in the battle against this disease which has for so many years ravaged our farms. It is the duty of the banker, the merchant, the physician, the lawyer, the minister, the laboring man, and the manufacturer, as well as the farmer himself, to see that proper funds are appropriated to carry on the strong campaign that is necessary for a winning fight against the disease.

As evidence of the ruin which has been produced in recent years, and the effects which are being manifested in the swine industry of the United States, the following figures from the United States Bureau of Animal Industry are of interest.

In the year 1907 the following figures were given for the number of animals which were inspected by United States Government Inspectors on antemortem inspection:

Antemortem Inspections of Animals About to Be Slaughtered, Fiscal Year 1907

Kind of animals.	Passed.	Suspected.[1]	Total.
Cattle	7,606,653	25,445	7,632,098
Calves	1,760,203	3,382	1,763,585
Sheep	9,723,016	1,295	9,724,311
Swine	31,797,790	25,709	31,823,499
Goats	55,540	1	55,541
Total	50,943,202	55,832	50,999,034

In this year the United States Government inspection was in force in 708 packing-houses in 186 cities. At postmortem inspection the following number of animals were inspected:

Postmortem Inspections, Fiscal Year 1907

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle	7,593,220	564	27,993	7,621,717
Calves	1,757,112	48	6,414	1,763,574
Sheep	9,672,200	152	9,524	9,681,876
Swine	31,639,620	70,401	105,879	31,815,900
Goats	52,106	1	42	52,149
Total	50,714,258	71,166	149,792	50,935,216

This gives some idea of the enormous amount of food animals which are consumed in this country annually. Over 50,000,000 animals in all passed under United States inspection during this single year. Of this number, over 30,000,000 were hogs, giving again some idea of the enormous importance to the people of the United States of the hog-raising industry.

In the year 1908 the inspection figures were as follows:

Antemortem Inspections of Animals About to Be Slaughtered, Fiscal Year 1908

Kind of animals.	Passed.	Suspected.[1]	Total.
Cattle	7,198,224	32,048	7,230,272
Calves	1,993,461	2,134	1,995,595
Sheep	9,778,189	1,751	9,779,940
Swine	34,980,571	27,456	35,008,027
Goats	46,066	1	46,067
Total	53,996,511	63,390	54,059,901

[1] This term is used to designate animals found diseased or suspected of being diseased on antemortem inspection, most of which are afterward slaughtered under special supervision, the final disposition being determined on postmortem inspection.

In this same year the postmortem figures were as follows:

Postmortem Inspections, Fiscal Year 1908

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle	7,081,315	1,744	33,216	7,116,275
Calves	1,989,629	4	5,854	1,995,487
Sheep	9,694,359	96	8,090	9,702,545
Swine	34,878,469	106,675	127,933	35,113,177
Goats	45,920	.....	33	45,953
Total	53,689,692	108,519	175,126	53,973,337

During this year the figures reported show an increase of about 6 per cent., both in antemortem and postmortem inspection, but these figures are not so much due to the increased number of animals produced, as to the large number of new meat slaughtering plants to which the inspection was extended during the year. In 1907 there were only 708 establishments in 186 cities under United States Government inspection, while in 1908 inspection was maintained in 787 establishments in 211 cities.

In 1909 the inspection figures crossed the 55,000,000 mark, and of this number over 35,000,000 were hogs. This was an increase of only a little over 3 per cent., and was largely due to the fact that in this year the inspection was extended to cover 876 slaughtering plants in 240 cities. The complete figures of antemortem and postmortem inspection for this year were as follows:

Antemortem Inspection of Animals, Fiscal Year 1909

Kind of animals.	Passed.	Suspected.[1]	Total.
Cattle	7,547,969	40,175	7,588,144
Calves	2,059,529	4,050	2,063,759
Sheep	10,990,274	2,305	10,992,579
Goats	69,882	1	69,883
Swine	35,808,887	22,665	35,831,552
Total	56,476,541	69,196	56,545,737

[1] This term is used to designate animals found diseased or suspected of being unfit for food on antemortem inspection, most of which are afterward slaughtered under special supervision, the final disposition being determined on postmortem inspection.

Postmortem Inspections, Fiscal Year 1909

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle	7,287,793	2,441	35,103	7,325,337
Calves	2,038,494	4	8,213	2,046,711
Sheep	10,792,078	78	10,747	10,802,903
Goats	69,111	.....	82	69,193
Swine	35,244,005	97,014	86,912	35,427,931
Total	55,431,481	99,537	141,057	55,672,075

During the fall of 1909 cholera was especially severe throughout the United States, and this made a wonderful change in the figures for the year 1910, which were as follows:

Antemortem Inspections of Animals, Fiscal Year 1910

Kind of animals.	Passed.	Suspected.[1]	Total.
Cattle	7,956,427	43,120	7,999,547
Calves	2,293,216	2,584	2,295,800
Sheep	11,155,646	8,989	11,164,635
Goats	116,035	28	116,063
Swine	27,717,164	14,463	27,731,627
Total	49,238,488	69,184	49,307,672

Postmortem Inspections, Fiscal Year 1910

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle	7,916,601	3,162	42,426	7,962,189
Calves	2,287,568	7	7,524	2,295,099
Sheep	11,138,781	29	11,127	11,149,937
Goats	115,585	.....	226	115,811
Swine	27,532,600	70,982	52,439	27,656,021
Total	48,991,135	74,180	113,742	49,179,057

When we compare the figures for these two years they are found to be most interesting and instructive. The number of cattle, sheep, calves, and goats all show a slight increase in number, while the number of hogs slaughtered shows the enormous and startling

[1] This term is used to designate animals found diseased or suspected of being unfit for food on antemortem inspection, most of which are afterward slaughtered under special supervision, the final disposition being determined on postmortem inspection.

decline of over *seven millions!* This is a decrease of over 20 per cent., and, had this enormous rate of decrease continued, the hog industry would have been wiped out in the course of five more years.

This decrease is made the more remarkable when we consider the fact that during the year 1910 the number of plants under government inspection increased from 876 to 919, so that the total decline was even more marked than shown by the figures just given. This is a fair example of how this disease is threatening to ruin the swine industry of the United States. It is also a point worthy of note that during this time the price of pork food products was materially advanced, showing the effect of decreased supply and a constantly increasing demand. It is, indeed, an important question, well worthy of the best efforts of which our national and state governments are capable.

During the year 1911 the number of swine produced and sold for slaughter showed a slight increase over the previous year, due to the fact that many farmers and stockmen who had kept out of the hog-raising industry the previous year were determined to try another attempt after a year of empty hog lots.

The antermortem and postmortem figures for the year 1911 are as follows:

Antemortem Inspections of Animals, Fiscal Year 1911

Kind of animals.	Passed.	Suspected.[1]	Total.
Cattle	7,762,473	45,239	7,807,712
Calves	2,211,187	2,940	2,214,127
Sheep	13,001,932	3,890	13,005,822
Goats	54,373	9	54,382
Swine	29,892,489	27,772	29,920,261
Total	52,922,454	79,850	53,002,304

This shows an increase in the number of swine inspected of over 2,000,000, but is only a small gain as compared with the enormous loss of the previous year. Another notable fact about this report is the falling off in the number of cattle, due, in large

[1] This term is used to designate animals found diseased or suspected of being unfit for food on antemortem inspection, most of which are afterward slaughtered under special supervision, the final disposition being determined on postmortem inspection.

measure, to the fact that cattle raising without a good supply of hogs in the feed lots is unprofitable.

The postmortem figures for 1911 were as follows:

Postmortem Inspections, Fiscal Year 1911

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle	7,738,452	3,176	39,402	7,781,030
Calves	2,212,252	2	7,654	2,219,908
Sheep	12,994,681	32	10,789	13,005,502
Goats	54,084	.....	61	54,145
Swine	29,777,386	79,500	59,477	29,916,363
Total	52,776,855	82,710	117,383	52,976,948

Here, also, we have a gain of a little over 2,000,000, but the number of animals slaughtered still was over 5,000,000 below that of 1909, and shows a decrease of 12.4 per cent. over the average for the years 1907, 1908, and 1909.

Hog-cholera Serum

For the past fifty years veterinarians and stockmen of the United States have been making attempts to cure hog-cholera by means of various drugs and chemicals. Practically every drug in the entire Materia Medica has been used at one time or another, in the hope that finally some remedy would be found which would be capable of checking the ravages of the disease. In many cases one or another remedy has been brought forth and urged as a sure cure for the dread disease. The farmer and stockman have in such cases been led to purchase large amounts of the supposed cure. In practically every instance the final result has been the same. The supposed "cure" proves to be a miserable failure when it is brought into the actual field tests. Hog raisers have spent hundreds of thousands of dollars in purchasing this worthless material, and, as a result, the farmer has formed the opinion that practically all hog-cholera remedies are fakes.

This long-continued deception, which in many cases was pure and simple fraud, has made it difficult for the advocates of the hog-cholera serum method of treatment to get a proper opportunity to demonstrate the efficiency of the new agent. Farmers have

become convinced that all hog-cholera remedies are a fake, and they are unwilling to make any further expensive experiments. In many cases the treatment has even been refused when the serum was supplied free of cost, as in the case of the recent United States Government and State experiments.

Advances in human medicine, with treatment of disease by means of so-called serums, led to awakening of interest in the veterinary profession along this line of experiment. It was soon realized that if a serum could be produced which would prevent and cure hog-cholera a most wonderful work would have been accomplished; one that would save millions of dollars to the swine raisers of the United States every year.

Discovery of Serum.—The first real attempt to produce a successful serum was initiated by the United States Government in the early part of the present century. As a part in the carrying out of the experiments directed to this end a serum plant was established at Ames, Iowa, and here the birth of the present method of handling hog-cholera took place. Drs. Niles, Dorset, Day, and Shores, of the United States Bureau of Animal Industry, were assigned to duty at this experiment station, and, working on the theory that what was possible in human practice should also be possible in the lower animal, they began an extensive series of experiments, with the ultimate object of developing a remedy that would save the lives of the enormous numbers of swine which were being sacrificed every year throughout the United States.

These men were taking up a strange and unexplored field, and their incentive was purely scientific interest and a desire to promote the interests of the farmer and stockman. They had no commercial object in view, and too great credit cannot be given them for the enormous work that they accomplished. In a very unpretentious little plant, located in a woods pasture a few miles out of Ames, and supplied with only the simplest of materials with which to work, these employees of the Bureau of Animal Industry carried out to a successful close a series of experiments that revolutionized the management of hog-cholera, and changed it from the most dreaded of animal plagues to one that gives promise of soon becoming a thing of the past. These men had no applause of the multitude or public notoriety to cheer them on, but, unnoticed and

unapplauded, they kept up the tedious daily grind, until they had finally completed an accomplishment equalled only by that of Pasteur in the handling of rabies. To Drs. Niles and Dorset especially belong the credit of developing the serum treatment for cholera, as their efforts along this line have been untiring, and they are to-day the two leading exponents of this method of controlling the disease.

The experiments at Ames were carried on for a number of years before any definite announcements were made as to the results accomplished. Short reports were made from time to time, indicating that progress was being made. It was not, however, until careful field tests had been made with the use of the new product in actual field management of hog-cholera that any report of an extensive nature was made. Patent was then taken out on the process of manufacture in the name of the people of the United States, in order that the rights to manufacture and use the new treatment might not fall into the hands of some private individual that would be able to control the supply of the necessary serum and charge exorbitant prices for the treatment. This was a most worthy move, and one that ensures the supply of serum being furnished at the lowest possible price consistent with the high standards of purity that must necessarily surround its manufacture.

In the annual report of the Chief of the Bureau of Animal Industry for 1907 the first extensive report of the use of the serum method in treatment of cholera was made. This report quoted a large number of actual field experiments, and is largely reproduced in a later section of this work. The effect of this announcement by Dr. Niles was to stimulate in all parts of the country more pronounced efforts along the line of serum production. Many of the state experiment stations were already making extensive serum tests, and the favorable nature of the Bureau of Animal Industry reports stimulated them to further effort.

Fake Serums.—About this time there also entered the field a large number of private manufacturers. In a considerable number of instances these private serum dealers were large commercial drug supply companies who were merely seeking to supply a public demand. In such cases the serum produced was in most instances of good quality and has given good results. The opportunity for gain,

unfortunately, also attracted a large number of dishonest men, who were brought into the field merely because it offered a chance to pick up some easy money. These men were of the same type and character as those who had already mulcted the farmer for hundreds of thousands of dollars for worthless hog-cholera remedies, and who now sought to add to their ill-gotten gains by supplying a worthless serum.

This could have only the one result. A large amount of serum was rushed on the market which was improperly and, in many cases, carelessly made. This worthless stuff was in many cases offered at a much lower price than that asked for a high-grade serum. Many stockmen, not realizing the importance of quality in the product, were attracted by the lower prices and, as a result, treated their herds with the low-grade serum. In such cases the outcome was that they found they had spent their money for a product which was as valueless as the other hog-cholera "cures" they had previously used. These men at once came to the conclusion that hog-cholera serum was of no value, and they became opposed to the treatment.

Officials of the United States Bureau of Animal Industry and the heads of the agricultural department of the various states were convinced that the serum was all right, and that its use was founded upon a firm scientific basis. They were undismayed by the unfavorable reports that began to pour in from all parts of the country following the use of the improperly prepared serum. They worked only the harder to perfect the methods of manufacture and administration of the serum, and the value of their untiring efforts is to be seen to-day in the ever-increasing number of men who report success in the use of hog-cholera serum. There can be no longer any question of the sound foundation of this method of treatment, and it only remains to develop practical plans for carrying on the campaign against cholera in such a manner as will ensure its eradication in the shortest possible period of time.

During the session of the United States Congress in the winter of 1912 and 1913 an appropriation of $75,000 was made for the purpose of carrying on public demonstrations of the value of hog-cholera serum as a method for treating hog-cholera. This work was commenced on the first of July, 1913, and was the first real exten-

sive experiment in the handling of the disease by means of serum. Previous efforts had been limited in scope by the small amount of available funds, and the advocates of the new treatment were unable to carry out the work with their own personal funds.

For purpose of carrying out these experiments one county each was selected in Indiana, Missouri, Iowa, and Nebraska, and arrangements made to carry out the work in co-operation with the state and county agricultural and veterinary authorities. In most cases the work was more or less closely affiliated with that being done by the state experiment stations.

Stimulated by the example of the Federal Government, many of the State Legislatures made appropriations for conducting of experimental demonstrations on the part of the state agricultural college as experiment stations. Serum plants are now in operation in practically every important hog-raising state, and this method of treatment is rapidly coming to the front and receiving the delayed recognition that has been due it for a number of years.

Results of the 1913 experiments have been very encouraging, and the action of the 1913 and 1914 Congress in materially increasing the appropriation for carrying out this work gives promise of widening the scope of the investigations to such a degree as will conclusively demonstrate the fact that we have in hog-cholera serum a method of management of cholera that is of genuine worth, and one which, when properly extended, will entirely eradicate the disease.

The capacity of the Bureau of Animal Industry serum plant at Ames has been enormously increased, and the production of serum by the various state serum laboratories is now much larger than it was a few months ago. This will make it possible to carry on the 1914 campaign in a much more vigorous manner. During the summer of 1913 the men in the field were often handicapped by the fact that they were inadequately supplied with serum. The fact that the Bureau of Animal Industry experiments were not started until after July 1st was also a severe disadvantage, as cholera had already got a wide foothold in many localities at this time, and it was difficult to get the outbreaks under proper control, as would have been possible earlier in the year had the funds been available at that time.

SCIENTIFIC BASIS OF SERUM THEORY

In evolving the serum treatment for hog-cholera the early workers in the experimental field were prompted by the scientific principles which are believed to underlie the protective power which some animals have against disease. Every farmer knows that cattle are not susceptible to hog-cholera, and will not become sick, no matter how often they may be in the same feed lots with hogs that have cholera. It has also been noticed in almost every outbreak that there will be one or two animals in the herd that do not seem to take the disease or, if they do, at least show very little or no symptoms of being sick.

More interesting still is the noticeable fact that after animals have been through an attack of cholera, if they are not killed by the disease, they are usually left with some strange resisting power against cholera. As a result, they will not again take the disease, even though they be exposed in the same pens with animals that have the disease. This is a very interesting fact, and one that has attracted attention for centuries, not only in the case of hog-cholera, but in numerous other diseases of man and animal as well. For instance, it has been noted for centuries that after a man has had one attack of small-pox he is not likely to ever again have the disease.

This strange protective power that is left after an attack of disease has been designated in scientific works as *immunity*, and has been the subject of much thought and study by some of the most brilliant minds of the past as well as the present century. Many plans have been devised to show why this should be so. None of the theories advanced has ever proved entirely satisfactory. At the present time the explanation advanced by Professor Ehrlich, of Germany, is the one most favorably regarded.

Varieties of Immunity.—This resisting power or immunity to disease is of more than one kind. For instance, in the case of cattle, all the animals of this species have a strong resistance against hog-cholera. In like manner, they are not affected by swine plague, chicken-cholera, and many other diseases that attack other domestic animals. Calves are born with this immunity to the diseases just mentioned, and it is just simply natural for them to have this

immunity to these conditions. Accordingly, this type of resistance against certain diseases is known as *natural immunity*.

In some few cases an animal is born with a resistance to a certain disease which may have attacked the sire or dam. In such cases the young animal has conferred upon it a certain amount of germ-resisting power against the particular germ that produced disease in the parent. An immunity of this type, derived directly from one or the other parent, is an hereditary acquirement, and is classed as *hereditary immunity*. This form of protection is uncommon and is often only temporary in nature, as in the case of young pigs born from mothers that have been through an attack of cholera.

In other even more rare cases the unborn animal suffers from an attack of some disease while still in the uterus of the mother. In such cases the pig is born with a protective power against this particular disease. Such an immunity as this, obtained as a result of an attack of the disease while in the womb of the mother, is known as *congenital immunity*.

Unfortunately for hogs, they are not naturally immune to hog-cholera, and hereditary immunity to this disease is also comparatively rare. In those cases where an hereditary resistance is inherited, it is comparatively weak, and after the pig is weaned the protection lapses and is no longer of any value. Congenital immunity to cholera is so rare as to be hardly worthy of mention. In nearly every case where the pigs in the womb of the mother are attacked by cholera the sow aborts and slinks the entire litter.

Acquired Immunity.—Through a valuable provision of nature it becomes possible for an animal born susceptible to a certain disease to afterward obtain a protective power or immunity against this same disease and the germs which produce it. Coming as it does after birth of the animal, and being something that is acquired as the result of experience, it is spoken of as an acquired immunity. We understand, then, by an acquired immunity a protective power against a certain disease which is acquired or received after the birth of the animal. It differs in this respect from natural, hereditary, or congenital immunity in that all of these types are obtained as a result of some influence affecting the animal body before birth. Acquired immunity is the result of influences met with after birth.

The most common and the natural way of obtaining an acquired immunity is through an actual attack of the disease. For instance, if an animal has an attack of hog-cholera and successfully passes through the sickness there will be left on recovery a protective power that will prevent the attack of the body by the germs of this disease a second time. Almost every farmer and stockman has noticed this fact. Sows that pass through one attack of cholera and are kept over for breeding purposes are seldom attacked the following year, even though the disease may make its appearance in their litters about weaning time. It is an interesting fact, worthy of mention here, that the litters of these immune sows are furnished with a certain degree of protection which is in operation, as a rule, up to about the time of weaning. This has a practical importance in the management of hog-cholera which will be further discussed under the head of Simultaneous Serum Treatment. It is an interesting example of hereditary immunity and one that is of considerable scientific interest and actual importance.

There is one great disadvantage to acquiring an immunity by actual attack of the disease, in that there is always a large percentage of deaths among the hogs attacked. This is especially the case with hog-cholera. For instance, out of a herd of 100 gilts only 1 or 2 may be left after an outbreak of the usual severe type seen in the Corn-belt States. Immunity is a most desirable condition, and it is our aim to secure as large a number of immune hogs as possible, but if it has to be obtained at the expense of losing 98 per cent. of the herd it can hardly be classed as of practical advantage.

In order to devise a method of securing this protective power without entailing such an enormous loss among the healthy animals various methods have been tried out from time to time in hog-cholera, as well as numerous other diseases, for the purpose of developing a less costly means of securing the same advantage. The first real progress in this line was made in human practice many years ago by Dr. Jenner, in the discovery of vaccination as a means of preventing small-pox. This man found that by inoculating a healthy man with a weakened virus he was able to produce a mild local reaction which resulted in the development of a permanent protective power against small-pox. In veterinary practice

it was found a number of years ago that, by the use of weakened cultures of the black-leg germ, it was possible to secure a mild reaction which developed a resisting power or immunity to attacks by the vigorous germs of this same disease.

This second method of producing immunity by an injection of the body of the healthy animal with a weakened culture of the actual germ of the disease was never very successful in hog-cholera. This is, in large measure, no doubt explained by the fact that we are unacquainted with the exact definite character of the body which produces this disease. We are positive that there is some form of germ or virus in the blood of the sick animal, but just what it is and what its exact nature is, we must confess, still remains unsolved. If investigations now in progress solve this scientific mystery it may materially change and simplify the handling of hog-cholera.

It has been found in the case of hog-cholera, however, that injection can be made with a full-strength culture of the cholera virus without producing harmful effects, provided a dose of protective serum be given at the same time. This double injection results in a very mild, practically unnoticeable, attack on the body cells by the virus of cholera, and leaves as an after-result a permanent protective power against this same virus which is capable of producing such death-dealing results when given to the unprotected animal.

Active Immunity.—In these three methods of producing protection against disease it will be noticed that the cells of the body of the animal protected have taken an active part. In all these cases, whether there be an actual attack by the germs of the disease or a mild attack produced by a weakened germ or a healthy germ, counteracted by the presence of a protective serum, there has been an actual part taken by the cells of the body. This is, then, a protection acquired as the result of an active reaction on the part of the tissues of the animal body, and such an immunity is classed as an active immunity.

An active acquired immunity, then, is one which is acquired by the animal after birth as a result of an actual attack, or a mild attack, by the germs of the disease in question. This form of protection is usually long lasting in nature. In fact, it usually re-

mains throughout the natural life of the animal. This is due to the fact that the cells of the body have been trained in the art of germ defence, and they never lose the power of keeping a constant guard against attack by these same germs.

Passive Immunity.—It has been found by experiments that have been made on a large number of animals that the protective power of immunity which an animal that has been through an attack of disease acquires thereby is in large measure due to the presence of some new material in the blood of the animal. It has also been found that if the blood be drawn from the body of this animal and injected into the body of another animal it will protect this second animal against an attack by these same germs. In this latter case the protected individual acquires an immunity against the disease in question without any activity on his part whatever. The protected animal in this case is entirely inactive or passive, as far as developing any protective bodies is concerned. This type of immunity is, accordingly, known as a passive immunity.

Passive immunity differs from an active immunity in that it is not the result of an attack, either severe or mild, of the disease protected against. In active immunity there is always an actual attack by the germs of the disease, either in their full virulent power or in attenuated form. In passive immunity the animal acquiring this sort of protection merely allows the blood of an actively immune animal to resist the invasion of the germs. There is also a marked difference in the duration of the protection or length of time which it lasts. In active immunity, as has already been stated, the protection often lasts throughout the remainder of the lifetime of the animal. In passive immunity this is not the case. When the protecting blood is injected into the body of the susceptible animal it gives protection only so long as it remains in the body of the injected animal. This is only a comparatively short period—a few weeks at most. In the case of hog-cholera the average duration of the passive immunity given by injection of hog-cholera serum, when given by the single method, is six to ten weeks.

Summary of Immunity.—From the foregoing paragraphs we are able to arrive at the following conclusions concerning the subject of immunity:

(1) Immunity is a protective power against the invasion of the body by the germs of a certain disease.

(2) Natural immunity is a protective influence against the germs of certain diseases possessed as a natural inheritance by certain species of animals. An immunity, to be classed as a natural one, must be possessed by all the animals of that species. For example, the ox is naturally immune to hog-cholera. The hog is naturally immune to small-pox.

(3) An hereditary immunity is one that is conferred on the animal before birth as an inheritance from one or both parents. It differs from a natural immunity in that it is not possessed by all the animals of this same species. As a rule, it is the result of the mother or father of the animal having passed through an actual attack of the disease. For example, pigs born of mothers that have been through hog-cholera are often temporarily immune to the disease. Hereditary immunity is often only temporary in character and disappears as the animal gets older.

(4) Congenital immunity is that form of protection which the animal acquires as a result of passing through an attack of the disease while still in the womb of the mother. It is a comparatively rare form of immunity.

(5) By acquired immunity is understood an immunity or protective power acquired after the birth of the animal. The most common way of obtaining an acquired immunity is by an attack of the disease in either a mild or natural form.

(6) Acquired immunity is of two principal types, active and passive.

(7) Active acquired immunity is an immunity obtained as a result of an actual attack of the disease in either a severe or attenuated form. The germs of the disease are actually present, and produce definite reactions on the part of the cells of the body.

(8) This form of immunity is usually of a powerful type and is permanent in nature.

(9) Passive acquired immunity is an immunity which is conferred as the result of injection into the body of the protected animal of serum from the body of an animal which possesses an active type of immunity to this same disease.

(10) Passive acquired immunity is usually rather temporary in

nature, and passes off as soon as the protective materials injected have been entirely eliminated from the body.

Ehrlich's Explanation of Immunity.—Just why an animal that has been through an attack of a certain disease should no longer be susceptible to the attack of the germs of this same disease is rather hard to understand. It is easy to see that this is a wise provision on the part of mother nature, but, like many other of mother nature's simple workings, it has long been a mystery to the keenest of human minds how this state of affairs is brought about. Professor Ehrlich has devoted years of study to the subject, and his explanation of the reactions that take place to cause the development of immunity are perhaps the most acceptable of any theories that have as yet been advanced. Ehrlich's explanation, which is known in scientific works as Ehrlich's side-chain theory, is substantially as follows:

Every cell in the animal body must have nourishment. This nourishment is necessary in order that the cell may live, grow, and perform its allotted share of the daily work of the body. For the purpose of receiving this nourishment each cell is provided with small receiving arms, which are known as the *receptors* of the cell. In the normal healthy cell there is only one of these receptors, and if anything happens to disable or damage this receptor the cell must form another one to replace it before it is able to continue its daily work and keep up its natural growth and repair.

When the germs of a disease enter the body of an animal they are about to attack they at once commence to manufacture certain very poisonous materials which are known as toxins. The toxin is the weapon of attack of the germ, and it is with these toxins that they hope to destroy the cells of the animal body and become the victors in the battle that is about to take place between the cells of the body and the invading army of germs. After all, this is all that disease of any kind consists of. All disease is a battle between the cells of the body and the cells of disease, which are known as the germs. For instance, when the germs of pneumonia enter the body of man or animal they begin an attack, and this battle between cells and germs is kept up for many days. In some cases the cells win the battle, and then the patient gets well. In other cases the germs are returned the victor, and then the patient dies. The

object of the physician or veterinarian who is called to treat the case is to offer such aid as he may be capable of giving to assist the cells in their struggle against the germ invaders. In some cases this consists in the administration of such agents as will hinder the germs in their fight and make victory for the cells the more certain. In other cases the medicines administered are more on the order of whips to stimulate the cells of the body to put up a more masterful fight.

As just stated, the fighting weapon of the germ is the poisonous body known as the toxin. These toxins are provided with arm-like processes by which they are able to grapple with the cell, and these processes are known as *toxophores*. The toxophore is so arranged and organized that it is capable of grasping hold of the receptor of the cell and preventing the cell from obtaining the very much needed nourishment that it requires during its battle with the poisonous toxin. This, then, is the method of attack of germs in disease. They form large numbers of toxins which travel out into the blood-stream of the body and attack the normal tissue-cells in all parts of the body by means of their grasping tentacles or toxophores.

As in practically all other instances, nature has provided for a means of escape in this dire necessity of the cell. When a receptor has been grasped in the fatal embrace of one of these toxophores, and the cell is no longer able to secure the much-needed nourishment from the blood-stream to wage its battle against the disease, it at once sets about to produce a new receptor. In doing this the cell seeks to provide for future emergencies, and so, instead of producing one receptor to replace the one that has been disabled by the attack of the toxophore, it reproduces a large number of them.

In the course of the warfare between body cell and germ toxin the cells discover the fact that the toxins are capable of producing only the one toxophore, and that if this toxophore be grasped by a cell receptor the toxin is unable to make any further attack. This suggests to the cell the advisability of liberating in the blood-stream a large number of receptors for the purpose of engaging and disabling the toxins before they are able to attach themselves to a body cell. As a result of this plan, the large number of receptors that were formed to replace the one disabled by the attack of the

toxophore are cast off and sent out to meet the oncoming horde of germ toxins. Other cells that have not yet been attacked are also enlisted to aid in the battle, and soon the blood-stream is swarming with these newly formed receptors, each looking for a toxin to attack and disable. These receptors in the blood-stream are decided workers against the poisonous bodies of the germ invaders, and they are, accordingly, classed as *antibodies*. It is due to the presence of these antibodies in large numbers that the attack of the disease germs is finally checked and recovery takes place. In some cases the germs are too quick for the body cells, and flood the blood-stream with toxins so rapidly that all the cells are destroyed before they have had a chance to form antibodies in sufficient number to repel the invasion. In such cases the outcome is fatal and death takes place.

In those cases that do recover the cells of the body have been taught a valuable lesson. They have learned that they need protection against these particular germs, and they also find that they have acquired the power of manufacturing a defensive body that is capable of affording this protection. The cell, therefore, concludes that it is the part of wisdom to see that the blood-stream is at all times kept supplied with a plentiful number of antibodies.

It is due to the continuous presence of these antibodies, or germ fighters, in the blood-stream that the animal maintains a defensive power against this particular disease. This defensive power is what is known as immunity. Immunity, then, is the result of the presence in the blood-stream of a large number of defensive agents known as antibodies. The permanent character of this form of immunity is explained by the fact that the cells, which have learned their lesson in the school of actual experience in germ warfare, never allow themselves to again become open to attack by these same germs. Just as the nation which is caught unprepared for war learns its bitter lesson, and forever after keeps up a strong army and navy for defense against an invader, so the body learns its lesson, and maintains a strong army of defense against subsequent attack.

An immunity acquired in this manner is spoken of as an active immunity, due to the fact that the cells of the body took an active part in its production, and continue to actively take part in m[illegible]

taining it by constantly keeping up the supply of germ-fighting bodies.

It is due to the continued maintenance of the large supply of these germ-fighting antibodies in the blood-stream that the serum from this animal can be taken and used as a protective agent in the body of another animal. This is the most important fact in connection with immunity. It is on account of this power of protecting a healthy animal by injection with antibodies derived from an animal that has passed through an attack of the disease that the so-called serum treatment of disease has been developed. Hog-cholera is only one of the many diseases in which this has been found to be true. In connection with hogs, however, the immunizing power of blood of an animal that has been through an attack of cholera is of most importance, and it is with respect to the immunizing power of blood from a hog that has been through an attack of cholera that we are most concerned in this book.

In studying immunity and the manner of its production, a most important discovery was made many years ago, in that it was found that it was not necessary for an animal to have a severe attack of a disease to develop immunity to future attacks by the same germ. It was found that if a weakened culture of the same germ was injected it produced a reaction which left the same degree of protective power as resulted from a severe attack by the disease itself. This fact has been taken advantage of in human practice in vaccination against small-pox, and is being used in a modified form in the treatment of hog-cholera by the double or simultaneous method.

Hyperimmunization.—Investigators in the field of immunity have found that an animal which possesses an immunity against disease can stand an attack by the germs of that particular disease in almost any number. Not only is this animal proof against the usual fatal dose of these germs, but this same animal is able to withstand the attack of these germs in enormous doses—even up to one thousand times the usual number.

The introduction into the body artificially of these large doses of germs in an immune animal was found to have no bad effects, in so far as producing sickness or disease is concerned. It was found, however, on testing the blood of an animal that had been given

these large additional doses of disease-producing material that the number of antibodies contained therein had been materially increased. This was a very important discovery. The degree of protection that the blood offers against invasion by the germs is in direct proportion to the number of antibodies to be found in the serum obtained from it. If, therefore, we are able to increase the number of antibodies by injection of more germs after the animal has developed an immunity, we are able to produce an animal that has even greater protective power than that possessed by the regular immune hog. This condition of high-degree immunity is known as hyperimmunity, and the animal having a protective power of this high standard is known as a hyperimmune. The injection of virus material to produce this condition of hyperimmunity is known as hyperimmunization.

This is the essential process in the manufacture of what is known as hog-cholera serum, as we shall find when we take up the consideration of the method of producing this very valuable therapeutic agent. It is the blood from hyperimmune hogs which is taken for use in protecting other hogs against the attacks of the hog-cholera virus. By the process of hyperimmunization the formation of enormous numbers of the germ-destroying antibodies is encouraged, and the blood from one of these animals is, accordingly, a very powerful protective agent in the defense against attack by the virus of the disease.

Summary.—In considering the manner of production of immunity the following interesting facts are worthy of reconsideration:

(1) Immunity is the result of the presence in the blood of a large number of germ-fighting bodies which are known as antibodies.

(2) These antibodies are formed by the cells of the animal body as a result of an actual attack by germs or virus of disease.

(3) Once the cells of the body acquire the knowledge of how these antibodies are formed, and the important part they play in defense against disease, they never neglect to keep a plentiful supply on hand. As a result, the body is always prepared to resist a second attack by these same germs.

(4) The antibodies are not damaged by withdrawal of the blood from one animal and injection into the body of another animal of

the same species that does not possess an immunity to the disease against which they are protective agents.

(5) On the other hand, these antibodies, when injected into the body of an exposed animal, act as protecting agents, and prevent an attack of the disease in the animal into which they have been injected.

(6) In an immune animal future attacks by the germs of this particular disease produce no symptoms. They do, however, stimulate the further production of germ fighters or antibodies.

(7) If enormous doses of the disease virus are introduced, marked stimulation of the cells takes place, and there is an enormous increase in the number of antibodies to be found in the blood-stream.

(8) Injection of large amounts of virus for purpose of stimulating antibody formation is known as hyperimmunization. The animal so treated is classed as hyperimmune.

(9) The blood from one of these hyperimmune animals possesses unusual protective power when injected into the body of another susceptible animal which may have been exposed to the same disease.

(10) By use of a hyperimmune blood we are able to give much smaller doses and get the same amount of protection as from enormous doses of blood from an animal that has only a simple immunity. This materially lowers the cost of production of the serum and the expense of treatment.

MANUFACTURE OF HOG-CHOLERA SERUM

For a number of years hog-cholera serum has only been manufactured by the United States Government, the various state experiment stations, numerous large pharmaceutic houses, and several private or commercial firms that sprung up here and there over the country. In the past year the demand for serum has become so much greater than the available supply that a number of prominent veterinarians over the country have completed arrangements to enter into the manufacture of serum on a small scale for their own private use.

The manufacture of this product is very simple, but, at the same time, requires a very thorough knowledge of the elementary principles underlying its production, and, above all, a most careful

regard for cleanliness. The watchwords for success in manufacture of serum are carefulness and cleanliness. With this motto the manufacture of hog-cholera serum is a comparatively simple process.

Immune Hogs Necessary.—The first essential in the manufacture of serum is to secure some immune hogs with which to start. The main point in preparing serum is the production of a blood that contains an enormous number of germ-fighting bodies, and this can only be done where we have immune hogs that are

Fig. 56.—Virus operating room in State Serum Plant at Nashville, Tenn. Giving intravenous injection of virus for production of hyperimmunity.

capable of receiving large doses of virulent blood without harmful effect.

In securing these immune hogs there are two principal sources of supply. One means is to secure hogs that have passed through an attack of cholera and have been left with an acquired immunity. This source of supply is, however, very limited, and, as such animals are highly prized for breeding purposes, the expense would be almost prohibitive.

The better method is to purchase animals that have been re-

cently given the simultaneous or double treatment. In such animals there is produced a permanent type of active immunity, as a result of which these hogs can be given enormous doses of hog-cholera virus without any effect other than stimulation of the production of antibodies.

In these cases where it is not easy to secure hogs that have already received the simultaneous treatment, the next best plan is to secure a number of swine and inject them by the double method. In this way immunity is produced, and we have a herd of our own ready for use. This last plan has one disadvantage, in that it will be necessary to wait for a few weeks before beginning the process of hyperimmunization. In serum plants where check pigs are used to test serum the pigs that are treated by simultaneous method in testing out the potency of the serum can be kept, and allowed to run in pasture for several weeks until they reach the necessary size to make their use for serum production profitable. In this manner a constant supply of immune hogs will be on hand after the first few months the plant is in operation.

Some serum manufacturers who are afraid of or opposed to the double method of treatment produce immune hogs by giving a dose of serum to a number of hogs, and then turning them into a pen that is infected with cholera virus by the presence of hogs sick with the disease. This method is a little uncertain, as all of the hogs so treated may not develop a permanent type of immunity. The most certain and the most economic method of securing immunes is by injecting as many as are needed by the double or simultaneous method. It is necessary to wait for at least twenty-one days after giving of this double treatment before further injections are given for the purpose of producing the condition known as hyperimmunity. This wait is necessary in order to give the cells of the body time in which to accustom themselves to the work of manufacturing the needed antibodies with which to withstand the enormous doses of virus blood that are to be given later on.

Source of Virulent Blood.—As the next step in the process of serum manufacture it is necessary to inject into the body of these immune hogs a large dose of virulent blood. This virus blood contains an enormous amount of the germs or virus that produces hog-cholera, and the object of the injection is to stimulate the

cells of this animal's body to the production of the highest possible number of antibodies. The means of obtaining this virus blood is the biggest problem in the manufacture of hog-cholera serum, and many solutions have been offered.

Stock-yard Virus.—The easiest means of securing virus is by sending men to the slaughtering plants where hogs are killed, or make some arrangements with the proprietors of these slaughtering plants to secure the blood from all animals killed that are suffering from cholera. Where this is done, the usual plan is to take these hogs that show signs of cholera when received in the stock-yards, and when they are killed the blood from them is saved and injected into the immune hogs for the purpose of producing cholera serum. In some cases an effort is made to observe these animals after slaughter and examine them for lesions of cholera.

This plan is the cheapest way out of the difficult problem, but it is also the least desireable. Virus obtained in this manner is always of questionable potency, and very often is drawn under conditions that do not tend to furnish a product that is free from contamination with other germs as well as the germs of cholera. This is a very important matter. The purity and strength of the virus is of the most extreme importance in determining the quality of the serum that will result. Low-grade virus means a low-grade serum, and this means poor results when the serum is used in the field.

In the manufacture of hog-cholera serum it is desirable that we obtain a virus of the highest possible disease-producing power. The more powerful or virulent the virus, the more pronounced will be the reaction on the part of the tissue cells. This means more antibodies, and the more antibodies that are formed, the more potent will be the serum that results. In using a slaughter-house virus we have no means of determining whether the virus present is of a powerful grade or of a low type of disease-producing quality. Where it is desired to produce the highest possible quality of serum this means of securing virus should not be considered.

Field Virus.—Another method of obtaining virus blood for hyperimmunization purposes is to draw blood from those animals which are first attacked at the beginning of an outbreak. It has been found that the virus of cholera is always apparently a little

more powerful or virulent at the commencement of an outbreak than it is later on. As a result, if we take the first few animals that appear real sick when the disease first appears on a farm and bleed them, we obtain a virus that is usually of high quality. This method for securing virus is a practical one when the laboratory is conducted by a state experiment station, and men are constantly in the field who are trained in the manner of drawing and handling of virus. In the state of Ohio this plan is followed to a very large extent, and it is the opinion of the officials there that they are getting a virus which is of very high quality. This plan has another advantage, in that it is comparatively cheap. By selecting those animals that are very sick at the time the farm is visited by the state inspectors, it is usually possible to secure the consent of the farmer to kill them, as he recognizes that they are almost certain to die anyway.

Injection Method.—The third and, I believe, the most practical method of securing hog-cholera virus for this work is to secure a virus that is of the highest obtainable quality, and then reproduce this strain of virus by injecting it into the body of a number of small shoats that possess no immunity. In this manner the virus is given an opportunity to reproduce in the body of the pigs, and is recovered a few days later in its most powerful form. Virus obtained from young shoats is always more powerful than that obtained from older animals, and for this reason it is desirable to use animals ranging from 60 to 100 pounds for this purpose.

By this method a virus is obtained that is of known potency, and also it can be drawn under conditions which ensure its being of the highest standard of purity. By this frequent passage of the virulent material through the body of young animals the potency of the virus is kept at a high standard, and this ensures a powerful serum. In the United States Bureau of Animal Industry Serum Plant at Ames, Iowa, Dr. Niles has used the same strain of virus for the last ten years, and produces a serum of unquestionable strength and protective power, as shown by the results of repeated field trials.

The greatest disadvantage to this method of securing virus blood is the cost. Young shoats of this size and age are rather hard to obtain, especially if the serum plant is not located at some

large packing center. Farmers do not care to sell pigs of this weight, as they are just beginning at this age to get to the point where they will show a profit. Last summer it was necessary for the Ames plant to offer as high as 12 and 13 cents a pound for pigs of this weight. As the amount of virus needed is large, and the amount of blood obtainable from a single pig of this weight very small, it can be seen that the cost of production of virus blood in this manner is quite high. In fact, the greatest expense attached

Fig. 57.—Pens in which hogs are placed for production of virus blood. Similar pens are used for housing of animals used in serum tests. (Photo by H. K. Mulford Co.)

to the manufacture of hog-cholera serum is the cost of the virus blood. If some means could be devised for cutting down this cost, without decreasing the quality of the virus, there would be a big reduction in the cost of serum treatment.

Manner of Securing Virus Blood.—The method of securing virus blood by means of injection of susceptible pigs with a virus of known quality is so far superior to other methods that it would seem advisable to give a detailed description of this method:

As already stated, there is selected for this purpose a virus that of the very best quality obtainable. This is injected in doses of to 5 c.c. into the muscles of the inner side of the thigh. The ıjected pig is then placed in a pen and allowed to remain there s if nothing had happened. He is given the usual feed at the sual time each day, and every morning the temperature should be ıken and record made of same. Usually about the evening of ıe fourth day there will be noted a considerable degree of fever, nd by the fifth day visible evidences of cholera will be noticeable. 'he pig will be seen to be off feed and may appear droopy and be ;ouring.

ig. 58.—Table for virus bleeding, horizontal position. In use at Tennessee State Serum Plant.

He is now ready to be killed, and most authorities agree that is better to kill the virus pig just as soon as possible after pro- ounced evidences of cholera develop, rather than wait until he in a dying condition. In some cases it will take longer than ve days for signs of the disease to make themselves noticeable ı these virus pigs. This in large measure depends upon the trength or potency of the virus blood used. The virus used at the ımes serum plant produces loss of appetite and marked rise in emperature, as a rule, on the evening of the fifth day.

Bleeding of Virus Pigs.—The sick animal is now removed to the

bleeding room, which is a specially prepared room set aside in the serum plant for the purpose of withdrawing this blood under the most cleanly conditions possible. This room is prepared with all the care of an operating room in one of our large city hospitals and is kept scrupulously clean, the great object at all times being to ensure the utmost degree of cleanliness.

Fig. 59.—Throat incision for virus bleeding. (Photo by Dr. Geo. R. White.)

When the sick shoat is brought into the bleeding room he is at once securely fastened to a table which will permit of one end being raised so as to allow the head and neck to be on a lower level than the rest of the body. This aids in the bleeding process, and enables the operator to secure a larger amount of blood. As this virus is very expensive it is desirable to obtain every possible drop. The pig is now securely strapped to the table and thoroughly washed around the point of proposed operation. This is done first with soap, water, and some good disinfectant solution, such as creolin. After a thorough scrubbing of the neck and anterior part of the chest, the parts are washed with alcohol and then painted with tincture of iodin. This renders the skin as clean and free from germs as it is possible to get it. This work is done by an assistant, and the operator who is to do the bleeding now commences his work.

The virus is obtained by bleeding from the large blood-vessels located in the neck. An incision is made in the midline of the neck and the vessels exposed. There are a number of ways of withdrawing the blood. The most common method is to simply cut

across the large blood-vessels and catch the blood in clean bottles as it escapes from the wound thus made. A somewhat more cleanly method is to introduce a hollow metal or glass tube into the blood-vessel and allow the blood to flow through this tube.

Fig. 60.—Bleeding for virus. (Photo by Dr. Geo. R. White.)

In either case the operator is provided with large-sized bottles or small buckets, which have been thoroughly washed and further freed of germs by sterilization in an oven. Into these clean, germ-free containers the virus blood is allowed to flow. Every precaution is observed to see that no dirt enters the vessel with

the blood. For this purpose the pig is covered over usually with a clean white sheet that has been previously dipped in a solution of one of the powerful disinfectants, the object of this being to prevent any dirt from the skin of the animal falling into the bottle or other container along with the blood.

Toward the end of the bleeding it is of advantage to loosen the front legs of the animal and perform artificial respiratory move-

Fig. 61.—Bleeding for virus. Showing use of tube for drawing blood. (Photo by Dr. Geo. R. White.)

ments, as this aids in emptying the larger blood-vessels and increases the amount of virus blood obtained.

As a further precaution against any contamination of this virus blood with germs of other kind than those of cholera, the operator who is to do the bleeding should thoroughly wash his hands in soap and water and effective disinfectant solutions before commencing the work. In fact, he should make just the same preparation that he would make if he were about to perform an operation upon the organs of the abdominal cavity. The knife and other

instruments should be perfectly clean and should be handled by no one except the operator. It is also advisable for this man to wear a perfectly clean white gown or white duck suit, a clean one being provided every morning.

Just as soon as the animal ceases to bleed a clean cotton stopper should be inserted into the bottle, to prevent entrance of dust and dirt from the air. These bottles and corks should, of course, be prepared beforehand by thorough washing of the bottles, followed by rinsing in boiling water and sterilization with dry heat. The corks should be in the bottle at time of sterilization in the oven, and in this manner they are sterilized at the same time with the bottles.

The virus blood should be immediately shaken as soon as drawn for the purpose of preventing the formation of a clot. This can be done by hand or in a regular machine provided for the purpose. In small plants the virus bottles are usually shaken by hand for several minutes. This causes all the clot-forming materials to gather in shreds, and leaves the balance of the blood as a clear, red liquid.

After shaking for a few minutes, the blood is then poured into a large filter funnel and filtered through several layers of clean cotton or gauze. This filters out all the clot and allows only the serum and blood cells to pass through. It is now received in another perfectly sterile bottle, corked with a clean cotton stopper, and set aside for future use. This filtered blood constitutes the finished virus, which is used for injection into the immune animals for the purpose of stimulation of the production of immune bodies.

There is one other method of drawing virus that is practised by a few serum manufacturers. This is by means of injection of salt solution into the peritoneal cavity and later withdrawing this fluid. About 1000 to 1200 c.c. of normal salt solution are injected into the peritoneal cavity of the virus animal. Two hours later the animal is killed and the salt solution recovered from the abdomen. This method is used by Dr. Craig at Purdue University, but does not seem to meet with any very general favor by other serum manufacturers. Dr. Craig, however, reports very good success with the method, and the serum produced at the Purdue plant is well above the average in quality. Still another means of

obtaining virus is to place healthy shoats in an infected feed lot and allow them to contract the disease. These shoats are then bled in the usual manner and the blood so obtained used for injection purposes.

Regardless of the method of securing virus that may be used, a postmortem examination should be made of the virus pigs after slaughter. All the organs usually affected by hog-cholera should be examined and their condition noted. The skin should be noted for evidences of discoloration; the lymph-glands should be exposed

Fig. 62.—Exterior of bleeding room at H. K. Mulford plant, Philadelphia.

and swelling and congestion looked for; the organs of the abdominal and thoracic cavities should be observed, and especially the condition of the intestines, spleen, lungs, and kidneys. There should be sufficient evidence to warrant a diagnosis of cholera, and the more acute in type the disease appears to have been, the more available the virus. Evidence of mixed infection, or of a severe jaundice, is undesirable, and blood from such animals should not be used for virus injections. Especially should this be the case if there are any signs of abscess formation in the body

or any evidence of blood-poisoning. Slight pneumonia is permissible, but I question if blood should be used where there is marked consolidation of one entire lung or of both lungs. The object should be to obtain a virus that is absolutely pure, and of just as high a strength as it is possible to produce.

Especially should this be insisted upon where virus is being drawn to send into the field for use in giving the double method of treatment. Virus blood intended for use for this purpose must be of unquestionable quality. Any mixed infection with the germs of other diseases might prove sufficient to cause very disappointing results. Hog-cholera serum which is used to counteract the effects of the virus in these injections is only a protective agent against the germs of hog-cholera, and will not afford protection against the germs of pneumonia, pyemia, and various other infectious diseases.

Cultures as a Source of Virus.—Recent investigators in Germany have made attempts to culture the virus of hog-cholera on artificial media. Some success has been reported recently in this regard. Some workers have reported that they have been able to carry the cholera virus through several generations on culture-media, and then, by injection into pigs, have again produced the disease. This is a statement that carries large possibilities. If this be possible, we may have placed in our hands a method of securing cholera virus at a very small expense and in a very pure form. Such a source of virus would have a most beneficial result in lowering its cost, and, incidentally, would very much decrease the cost of production of serum itself, as the cost of the virus is one of the principal elements in the high cost of serum production. Further investigations along this line are being carried on both in this country and in Europe, and with the vast number of capable men now engaged in the work there can be but little question that the outcome is certain to be favorable in the near future. It seems almost impossible for the actual cause of the disease to remain a mystery very much longer, and with the discovery of the cause of the disease it seems highly probable that methods for its successful culture will rapidly follow. This will at once simplify the matter of virus production and serum manufacture.

Method of Hyperimmunization.—After the virus blood has been withdrawn and the clot removed it is set aside in a cool place until

ready to use. No addition of any kind is made to the virus that is intended for hyperimmunizing purposes, and, where possible, it is used within twenty-four hours after it has been drawn.

The immune animal which is to be treated is then brought into the hyperimmunizing room and prepared for the operation. In selection of animals for use as immunes there are a few points that should be kept in mind, as they will very much facilitate the work. In the first place, animals selected for this purpose should preferably be of the long, rangy type. The bacon type of animal seems to give a better serum, stands injecting and bleeding better, and gives more serum per pound weight than those of the lard type. Another desirable advantage for the immune hog is a rather heavy ear with prominent veins. This is especially of importance where the virus is to be injected by the intravenous method. A long tail is another desirable feature, as this insures sufficient amount of tail to allow of the numerous bleedings that are to follow.

In addition to being immune from cholera, the hog to be injected with virus should also be free from tuberculosis, as it would be highly undesirable to send out a serum drawn from an animal that was suffering from this disease. Such a serum would very likely contain germs of tuberculosis, and its injection in a herd could not be followed by other than bad results. The presence or absence of tuberculosis in the immune animals can be readily tested by means of the intradermal or skin test, injecting 1 or 2 drops of tuberculin between the layers of the skin. On examination of the injected spot twenty-four hours later a severe inflammatory zone indicates presence of tuberculosis in the animal.

Testing Immunity.—The immunity of the animals to cholera can also be tested by placing them for several days in an infected feed lot. This should always be done in the case of animals that are bought as immunes, with a history of having passed through an attack of cholera. In the case of those that are treated on the place by means of the double treatment, they can be immediately turned into an infected feed lot without any danger, and, if they remain well at the end of the three-week period which should elapse between giving of the double treatment and hyperimmunization, they may safely be regarded as suitable subjects for injection with the large doses of virus.

In *injection* of the virus it is necessary, first of all, to restrain the animal in some sort of suitable apparatus. For this purpose a large number of appliances and crates have been devised. Practically every serum manufacturer has some sort of apparatus of his own for the purpose. At some plants the hog is simply strapped down firmly on a flat operating table. In others it is fastened in a stanchion. In the majority of cases it is secured in some form of crate. The main object is to secure the animal with the least amount of inconvenience and handling, and at the same time

Fig. 63.—Hyperimmunizing by intravenous method. (Photo by Dr. Geo. R. White.)

have the head accessible to the operator. The apparatus shown in Fig. 63 is a very suitable one.

Either before being placed in the crate or immediately afterward the animal should be weighed. In most plants the crates are arranged on rollers, so that they can be rolled on the platform scales as soon as the animal has been secured in position and the weight taken. The weight of the crate is already determined by previous weighing, and this, subtracted from the total weight, gives the weight of the animal. These figures should then be carefully recorded on the record card of this animal. The weight is of

importance not only at the time of injection, but also is essential for comparative purposes later on when bleeding is commenced. Every animal should show a gain in weight during the week or ten days that elapse between date of hyperimmunization and the making of the first tail bleeding.

Methods of Injection.—The weight having been taken, and the animal securely fastened in position, we are now ready to proceed with the operation of hyperimmunizing. There are several ways of injecting the virus blood into the body of the immune hog, the more important being:

(1) By intravenous injection.

(2) By subcutaneous injection.

(3) By intraperitoneal injection.

Of these three methods, the one most used in this country is the intravenous. Each of the other methods have some advocates, but, in the main, their principal advantage is the fact that they are easier than the intravenous. In every other respect they are less desirable, and the serum obtained by use of either subcutaneous or intraperitoneal injection is not of as reliable a character as that secured when the intravenous method is used. Intravenous injection has the one objection that it is somewhat more difficult to give, especially in the hands of the beginner. The vein is often hard to locate, and even after months of work operators frequently have trouble in introducing the needle into the vein and securing injection of the large amount of virus blood necessary for this purpose.

Point of Injection.—In giving the intravenous injection practically all operators make use of the large veins on the upper surface of the ear. These veins are comparatively large and can be conveniently reached. As soon as the hog has been secured in the crate and the weight taken, the operator examines each ear, and selects the one which seems to offer the more suitable vein. This ear is then carefully washed with soap and water and one of the disinfectant solutions, liquor cresolis compound being the most commonly used. This is followed by shaving of the hair from the ear and a wash with alcohol, after which the ear is allowed to dry by evaporation of the alcohol. It is now ready for the injection.

The virus, obtained and prepared as described in a preceding

paragraph, is now made ready for use. It is poured into a large bottle which is graduated along one side, to show the amount of virus it contains and the amount that is being injected. This bottle is provided with a cork containing two holes, in each of which is inserted a glass tube. One of these glass tubes merely passes through the cork and opens into the top part of the bottle. To this tube a small hand-pump is attached, by means of which air can be forced into the bottle. This air raises the atmospheric pressure in the bottle and forces the blood out through the other glass tube, which reaches to the bottom of the bottle. Attached to the upper end of this long glass tube is a rubber tube, 2 or 3 feet in length, and on the end of this a needle intended for introduction into the vein. This needle is hollow, and allows of the passage of the virus blood from the rubber tubing into the vein of the animal. Needless to say, this bottle, the glass tubes, rubber hose, and needle are all carefully cleaned and rendered free from germs by boiling before use.

Many different types of needle have been devised for use in this intravenous work. Some are simple straight needles, others have a curved point, others have a peculiar curve to enable the operator to get a more firm hold on them, and more carefully guide their introduction into the vein, while still others are specially ground, to prevent penetration through both walls of the vein. Almost every man has some special preference for some particular type of needle. A needle that is convenient for one man may prove very awkward for another. The best plan is to try the various types until you get one that seems to particularly suit your needs, and then stick to it, or have the manufacturer make any change in it that appears to be especially desirable from your standpoint.

Estimating Dose of Virus.—Estimation of the dose of the virus blood to be given is a very simple matter. It is merely a question of the practice of the individual manufacturer. With a good virus of high potency an injection of 5 c.c. of virus blood for each pound weight of the animal is usually sufficient. This is the dose used at the Ames serum plant and a number of the state plants. Some men advocate giving as high as 7 c.c. of virus per pound, but, with a good virus, this large dose is unnecessary. One of the advantages of the intravenous method is the fact that it requires less virus by

this method than by either of the others mentioned. In the intravenous injection every bit of the virus enters the blood-stream and none is wasted. By the other methods it is always a matter of doubt just how much will be absorbed, and this means that larger doses must be given in order to insure favorable results.

Figuring on the basis of 5 c.c. to the pound weight of the animal, a 250-pound hog would receive 1250 c.c., or about 2½ pints of virus blood. When we consider that ½ of 1 c.c. of this same virus would be sufficient to kill a hog of this size that had no immunity to cholera, we can get some idea of the powerful protection that is given by the simultaneous method of treatment. An animal that three weeks before would have been killed within ten days by the injection of ½ c.c. of virulent blood, now receives two thousand times this dose of the same virus and shows no bad results. This in itself is one of the most powerful arguments possible to offer in favor of the widespread use of the simultaneous treatment. If this treatment will show such results as this at the serum plants, it will show equally good results in the feed-lots of the corn belt where hogs are produced in such large numbers.

As a matter of actual experience, it is found in the serum-manufacturing plants that the hogs given these large doses of hog-cholera virus for the purpose of hyperimmunization show little or no ill effects from the treatment. There may be a slight droopiness for an hour or so, and the animal may get a little sick at the stomach and vomit immediately after being released from the crate, but there is no sign of bad effects on the following morning, and a week afterward, when the first tail-bleeding is made, the hog should show a gain in weight of several pounds.

Introducing the Needle.—The next and, in fact, the most difficult step in the operation of hyperimmunization is the introduction of the needle into the vein of the ear. The vein to be used is selected, and the thumb and forefinger placed upon it near the base of the ear. By compressing it gently at this point between these fingers the flow of blood toward the heart is temporarily shut off and the vein swells up along its course. This makes it more prominent and increases the ease of inserting the needle.

The needle should be detached from the rubber hose that leads from the bottle containing the virus. It should be firmly grasped

between the thumb and forefinger of the right hand, and, by a quick movement, sharply plunged through the skin and underlying tissues into the lumen of the vein. It can be easily told when the needle is in the vein, as blood will flow out through the opening in the needle. The hose is now quickly attached, and the pressure of the air in the bottle raised by gently compressing the rubber bulb a few times. By repeating this pressure at regular intervals a constant flow of blood can be kept up through the needle and into the vein. This flow should be continuous, but not too rapid, the usual time taken to inject a 200-pound hog being about twenty minutes to a half-hour.

When the desired amount of virus has been injected the needle is removed, and the opening in the skin of the ear washed off with alcohol or touched with tincture of iodin. It is a good plan to also apply a small amount of styptic collodion or tar to keep flies from collecting upon the puncture wound and forming a sore. The animal is then loosened and turned out of the crate into a lot.

Before finally releasing the animal a tag bearing an identification number should be attached to the opposite ear by means of a hog ring. This number should be copied on the record card of the animal and serves as a means of future identification.

This record card should show the number of the animal, color, sex, weight, date of injection, temperature, and amount of virus given. One week later this card is sent to the bleeding room with the hog, and serves as a comparative record for determining the condition of the animal as a result of the injection of the virus.

For the first twelve hours after hyperimmunization the animals should be given but little feed, and should preferably be kept in a shaded feed lot, with plenty of water to drink. In hot weather they may show some signs of heat exhaustion or collapse as a result of the exertion, and also partly as an effect of the introduction of such a large amount of foreign material into the body. In these cases many lives can be saved by promptly injecting $\frac{1}{4}$ to $\frac{1}{2}$ gr. of strychnin in 1 ounce of whisky or aromatic spirits of ammonia. At the first signs of collapse the virus injection should, of course, be stopped and the animal released. Cold water may be applied over the head, but should not be applied over the balance of the body.

Keeping Needle in Vein.—Many operators have reported trouble in keeping the needle in the vein once it has been properly inserted. The least movement upon the part of the animal is likely to jerk the instrument out of position unless some means be used to prevent the occurrence of such a mishap. Once the needle has been jerked out of the vein it is very difficult to get it back in position, and often it is necessary to change the field of operation to the opposite ear. To prevent this occurrence the best plan is to make use of some sort of clamp or forceps to hold the needle firmly in place. A small artery forceps can be used for this purpose and clamped down over the needle behind the point of entrance into the vein. Special clamps are also obtainable for this purpose.

Subcutaneous Injection of Virus.—Some serum manufacturers in this country make use of a method of injection of hog-cholera virus in which the virus is placed under the skin instead of being introduced into the vein, as in the preceding method. This plan is also used to a considerable extent in European countries. The subcutaneous method is sometimes known as the Hungarian method, owing to its extensive use in the serum plant in Hungary.

There are two principal methods of using this subcutaneous method of hyperimmunization. One is to inject increasingly larger doses of virus each day for three injections. The three injections are given at intervals of three days to a week apart. In Hungary the interval between injections is even longer. This is known as the slow subcutaneous method. It was originally used by the United States Bureau of Animal Industry serum experts, but has since been discarded in favor of the intravenous method. Another method of subcutaneous injection, known as the rapid subcutaneous, is to inject at one time a large amount of virus beneath the skin. This may be pure virus or pure virus in connection with normal salt solution. In either case, the amount of virus injected must be larger than that used in the intravenous method.

There are some advantages and a number of disadvantages to the use of the subcutaneous plan of hyperimmunization. The principal advantage of the method is its convenience. It is much

easier than the intravenous system, and requires little or no skill to introduce the virus in this manner. The slow method has another advantage, in that it can be used where the manufacturer has not enough virus on hand at one time to complete the hyperimmunization. This condition may arise at a small serum plant, seldom if ever at large plants.

Some men seem to have a little bad luck with the intravenous injection, and report the loss of large numbers of animals following this means of hyperimmunization. Those who have used the method most extensively, however, do not report such results with any degree of frequency, and it is rapidly gaining in favor even with those that at first were unsuccessful in its use.

There are a number of serious objections to the use of the subcutaneous method. One of these is the question of absorption. This is the all-important point in hyperimmunization. It is not so much the amount of virus that we place in the body of the animal as it is the amount absorbed that counts in producing a good serum. The more virus we can get into the body and get absorbed without killing the hog, the better will be the quality of the serum resulting.

Dr. Connaway, of Missouri, is of the opinion that the subcutaneous injection of virus has an advantage, in that it leads to absorption through the lymphatics and brings the virus quickly in contact with those cells that are later to produce the antibodies. This may be true, but the fact remains that after subcutaneous injections there is often a large amount of the virus that remains at the local point of injection and is not taken up at all. Abscesses often form in the region of the injection, and this cannot have other than a bad effect upon the quality of the serum. An animal with several large abscesses over the body cannot have clean blood and cannot produce clean serum. Some of the toxic material, and often large numbers of the pus-producing germs, are taken into the blood and pass out with it into the serum.

Dr. Niles, of the Ames serum plant, reporting the results of his early experiments with the subcutaneous method, states that the serum so produced was unreliable. One batch might be good, while another might be almost worthless. Dr. Williams, of the Minnesota State Experiment Station, also reports a large amount

of worthless serum following the use of this method of hyperimmunization. Not only is the quality of serum obtained by the use of the intravenous method more reliable, but it is also far less liable to contain bacterial contamination than that which is prepared by the subcutaneous system.

There is another disadvantage, from an economic standpoint, in the use of the subcutaneous method. This is the amount of virus necessary for use. With the injection under the skin all operators agree that it is necessary to use a much greater quantity of virus blood than when giving the same virus by the intravenous system. As the cost of the virus is one of the main expenses connected with manufacture of serum, this is a point worthy of serious consideration. It is desirable to obtain a serum at the lowest possible cost consistent with a high-grade product, and if we can cheapen the cost by means of the intravenous method and get a better serum, there is no question in the wisdom of the course being followed in adopting this plan of hyperimmunization.

Still another item of expense that is added in the use of the subcutaneous method is the disposition of the carcass of the hyperimmune after final bleeding. In many cases that have been treated by the subcutaneous method such enormous abscesses form that the carcass cannot be used for food after slaughter. This means a considerable loss to the manufacturer, as with the intravenous method the body of the animal can be disposed of in the usual manner. There is nothing connected with the manufacture of serum that in any way lowers the value of the meat for food. In a large plant the condemning of even 10 per cent. of the carcasses for abscess would mean a big loss at the end of the year. The price of serum is high enough at best, and we should practice every possible economy to get the cost of production to the lowest possible figure, and make the treatment available to the greatest possible number of farmers and stockmen. The high cost of the treatment is to-day one of the biggest drawbacks to increase in number of serum-treated herds.

The Intraperitoneal Method.—There is still remaining a third method of hyperimmunization that is worthy of mention. This consists in injecting the virus not beneath the skin, but directly into the peritoneal cavity itself. This plan has been

carried out to some extent abroad, and also to an even wider degree in American serum plants. It is a system that has found more adoption among the workers in state experiment stations than among commercial firms or the Bureau of Animal Industry. It compares very similarly to the subcutaneous method, and has about the same advantages and disadvantages.

There is the advantage of comparative ease of injection, and perhaps less danger of producing death in the hands of an inexperienced operator. The main disadvantages are the frequent formation of large abscesses and even generalized pus infection of the blood-stream. Such animals cannot produce a reliable serum. Abscesses following the intraperitoneal method are if anything even more numerous than in those animals that receive the subcutaneous treatment. This also again interferes with the subsequent sale of the dressed carcass.

Serum derived from the intraperitoneal method is also likely to be unreliable in protective power. It may or may not prove to be therapeutically active when taken out in the hog-cholera districts and injected.

Tail Bleeding For Serum.—After the animal has been hyperimmunized he is placed in the feed lot and allowed the usual attention given to feeding hogs. Food and water of the usual character and amount are provided, and no special attention paid to the animal. It is a good plan to keep a daily record of the temperatures in order to see that no undesireable reaction takes place. This daily temperature record may be kept upon the identification and record card already mentioned, and which was made out at the time the animal was first immunized by the simultaneous method, or, if not used at that time, should be made out at time of hyperimmunization.

One week after hyperimmunizing, the hog is ready for the first bleeding. Some men wait ten days, but the usual period is one week. Where plenty of time is allowable it may be as well to wait until the tenth day. During this time there has been a severe attack upon the defenses of the body by the toxins of the hog-cholera virus injected in such enormous quantity—many thousand times the fatal dose. The cells have been trained for just such an emergency as this by their experience three weeks previously with

the simultaneous treatment. As a result, the army of toxins meets with an equally well-trained defensive army of antibodies, and the battle is on. The cells, stimulated by calls for help from the struggling antibodies at the front, immediately put on full steam in the turning out of new receptors that enter the blood as germ-destroying antibodies. These swell the number in the blood-stream until they reach an enormous total by the end of the first week or ten days. The invading foe has long since been vanquished, and the cells are keeping up the supply of antibodies to a

Fig. 64.—Tail bleeding for serum. (Photo by Dr. Geo. R. White.)

high standard to prevent any surprise by a lurking germ enemy. The blood is now at its highest standard of strength, and this is the time at which it should be drawn and prepared for use in defense of other hogs that may be threatened with attack.

Bleeding for Serum.—The animal is now brought back into the operating room and prepared for bleeding. This preparation consists in restraining the animal again in a suitable crate or upon an operating table. The animal is weighed, and this weight compared with that on the date of hyperimmunization. The animal should show a gain in weight between these two dates of approximately

5 or 6 pounds. Blood should not be drawn if the animal has shown a loss in weight or shows evidence of an abnormally high temperature.

After having been secured and properly fastened the hog is taken into the bleeding room, and preparations are now made to withdraw the blood. The point selected for this purpose is the tail. This organ is drawn out through the rear end of the crate and very thoroughly scrubbed with soap, water, and creolin or other

Fig. 65.—Bleeding room of modern serum plant (State Serum Plant, Nashville, Tenn.).

coal-tar disinfectant. Following this it is carefully shaved and bathed with alcohol. It is now ready for operation. The operator now comes on the scene with a sharp chisel which is to act as the guillotine, and a small block of wood which serves as the block. The tail is laid upon this piece of wood, and with one blow of the chisel about 1 inch is clipped from its end. The chisel and block used in this operation are perfectly clean and washed with alcohol just before use.

Just as soon as the end of the tail has been clipped off it begins to bleed vigorously. As a rule, three small jets of blood are given off, the larger one being above the two smaller ones located on the same level beneath the center of the organ. This bleeding tail is now held over the open mouth of a perfectly clean glass bottle or granite pail and the blood allowed to flow in. If a clot forms in the end of the severed blood-vessels the flow can be quickly stimulated by thumping on the end of the tail with the end of one of the fingers.

Amount of Blood to Be Drawn.—This is the next question of importance. How much of the blood can we withdraw at one time from the animal without killing him or seriously impairing his strength and vitality? Many experiments have been made along this line, and it is the general opinion that about 5 c.c. can be drawn for each pound of body weight. A little over this amount of blood is drawn, as there is considerable shrinkage in separating the clot and filtering the product. For instance, if the hog weighs 160 pounds 800 c.c. of serum should be drawn. This will mean the withdrawal of about 900 c.c. of blood.

As soon as the desired quantity of blood has been drawn from the animal the tail is tied off with a firm cord ligature, and the end painted with tincture of iodin and covered over with tar. This tying should be as tight as possible, otherwise the animal may continue to bleed for several hours, and lose an enormous amount of valuable blood. The tar, if placed over the cut end of the organ, prevents flies from getting at the raw surface and forming a sore.

The hog is now released and turned back into the pens to wait another week before being bled again. Record is made on the identification card of the number of the hog, the date, weight, amount of blood drawn, and condition of the hog.

This tail bleeding is repeated for three bleedings, at intervals of one week each. At each bleeding the animal is again weighed, and the amount of blood to be drawn is found by figuring on a basis of 5 c.c. for each pound weight. One week after the third bleeding the animal is again brought in and given an injection with hog-cholera virus. At this time there is again injected 5 c.c. of virus to each pound of body weight. The virus at this time is injected into the veins of the opposite ear from that used on the former occasion. This process of reinjecting with virus blood is

known in the serum trade as "rehyperimmunization" or "rehypering."

There is some question as to just how soon this should be done. At several plants they make four bleedings from the tail before again injecting with virus. This was formerly the practice in the United States Government Serum Laboratory, but they are now prefering to reinject with virus after the third bleeding. There is some question as to whether or not it does interfere with the strength of the serum to make more than three bleedings. The safer plan would seem to be to adhere to the three-bleeding policy.

Fig. 66.—Filtering hog-cholera serum to remove clot (Tennessee State Serum Plant).

Handling of Serum Blood.—As soon as the tail bleeding has been stopped the blood which has been drawn is treated in very much the same manner as that just described for handling of virus blood. The drawn blood is quickly shaken or placed in a shaking machine and the clot-forming material removed. It is then strained through a cotton filter, so as to remove any foreign material or shreds of clot.

This filtered fluid is received into large clean bottles which have

been thoroughly heated in a dry oven so as to destroy all possible germ contamination. This is the serum blood, and to this is added a small percentage of 5 per cent. carbolic acid solution. This is usually added in the proportion of 1 part of carbolic acid solution to 9 parts of blood; that is to say, 100 c.c. of carbolic solution is added to 900 c.c. of blood. This gives a solution which contains ½ of 1 per cent of carbolic acid.

We now have the complete hog-cholera serum. It is not, in reality, a serum at all, but merely a defibrinated blood taken from the body of a hog that has been hyperimmunized one week before with an enormous dose of hog-cholera virus. This blood contains an enormous number of germ fighters or antibodies, and it is to the presence of these antibodies that it owes its real disease-preventing properties.

The addition of carbolic acid in sufficient amount to give a ½ of 1 per cent. solution is for the purpose of preventing growth of any germs that may be present, and in this manner keep the serum from spoiling. The carbolic acid is not added for any beneficial effect that it might have in the treatment of cholera.

This serum is now placed in large dark-colored bottles, which are tightly stoppered and placed in a dark, cool cellar, where they are kept at a temperature of 50° F. or lower. This also prevents in large measure the growth of any bacteria. The serum is kept in these large storage bottles until it is intended for shipment to the field, when it is brought out and bottled into smaller glass-stoppered bottles. These are sealed over with paraffin or wax and sent out immediately.

These serum shipments should be made by as rapid a route as possible, and arrangements should be made to receive same immediately upon its arrival. It should then be placed in a cool place and kept there until ready for use. This is very important, as serum spoils very quickly if it is allowed to get warm and remain that way for any length of time.

In the process of manufacture every effort possible is made to keep all germs out of the serum, but even with the utmost care a few germs are bound to enter. It is not possible to boil the serum without destroying the antibodies to which it owes its value. Accordingly, these germs cannot be killed, but must be allowed to

remain. The next best plan is to take such measures as will prevent their growth in large numbers. This is done by addition of the small amount of carbolic acid, and also by keeping the serum in a cold place away from the light. Moderately warm temperature and light are two of the essentials to germ growth, and when fluids containing germs are kept cold there is very little growth on the part of the germs.

Rehyperimmunizing and Repeated Bleedings.—After the three tail bleedings above referred to, the animal is reinjected with virus blood, as just described, and again placed back in the pen. One week later he is ready for another bleeding. This new dose of the virus of the disease has served to further stimulate the action of the body cells, and they have turned out an even larger army of antibodies. This again ensures a serum that will be of a high standard of potency.

Following this hyperimmunizing process the animal is bled twice from the tail, and is now ready for the termination of the bleeding process, with a final bleeding and death of the hyperimmune. At this time the animal is brought into the operating room and placed on the table, as in the case of bleeding of pigs for virus blood. The neck is washed and shaved and the large vessels of this region are then exposed by an incision, and the blood withdrawn in the same manner as described in obtaining virus blood.

At this bleeding all the blood possible to obtain is withdrawn. The amount obtained will differ considerably in various animals, even of the same weight. As a rule, several thousand cubic centimeters are obtained. This is then treated in the same manner as that withdrawn through the tail. It is shaken, the clot filtered off, a small amount of carbolic acid added as a preservative, and then bottled and kept in a cool place.

The carcass is then dressed in the usual manner, and should be inspected at this time by a United States or city inspector, and, if there is no evidence of disease present, the meat can be passed for food. Those that show presence of disease should be condemned and sent to the rendering tanks to be made into grease or fertilizer.

SUMMARY OF SERUM MANUFACTURE

We have now seen how hog-cholera serum is manufactured, and it will be of interest to go back over the last few pages and summarize the principal points of importance:

(1) In the manufacture of hog-cholera serum it is necessary to have some immune hogs. By this we mean hogs that have a protective power against hog-cholera and will not take the disease.

(2) These may be obtained from a number of sources, the more important being by purchasing hogs that have been through a natural attack of the disease, by injecting hogs with serum and turning them in exposure pens where they come in contact with the germs of disease, or by treating them with the simultaneous method.

(3) It is next necessary to secure some virus blood. This may be obtained from cholera hogs slaughtered at public stock-yards, from sick shoats slaughtered at the commencement of an outbreak, by exposing healthy pigs in an infected feed lot, or by injecting healthy pigs with virus blood.

The most scientific of these methods is by the injection of healthy shoats with blood of known virulency.

(4) This virus blood is obtained by bleeding of the sick shoats, under the most cleanly conditions, from the large blood-vessels of the neck.

(5) This blood is defibrinated and filtered, and is now known as virus blood. It contains millions and millions of the virus or disease-producing bodies responsible for development of hog-cholera.

(6) This virus blood is then injected into the body of one of the immune animals. The immune animal selected for this test should have been treated by the simultaneous method at least three weeks before.

(7) The amount of virus blood to be given is 5 c.c. for each pound body weight.

(8) There are a number of ways of giving this virus, the more important being by injection into the veins of the ear (intravenous method); by injection under the skin of the belly (subcutaneous method); or by injection into the peritoneal cavity (intra-abdomi-

nal method). The most successful of these methods is the intravenous.

(9) One week after this hyperimmunization the animal is bled for the purpose of obtaining serum blood. This bleeding is performed by clipping off the end of the tail and allowing the blood to flow.

(10) The amount of blood drawn should be 5 c.c. for each pound of body weight.

(11) These bleedings are repeated at intervals of one week for three bleedings.

(12) One week after the third tail bleeding the hog is again injected with a dose of virus blood. At this time there is again injected 5 c.c. of virus per pound of body weight.

(13) One week after this rehyperimmunization the hog is again ready to bleed.

(14) The bleedings are now made from the tail at intervals of one week.

(15) At the end of the third week the animal is given a final bleeding and slaughtered. The blood at this time is drawn from the large vessels of the neck, as in the case of the virus pigs.

(16) This blood obtained from the tail bleedings is placed in shaking or defibrinating machines just as soon as drawn, and vigorously stirred or shaken until all the clot is separated from the fluid of the blood. This is now filtered through cotton or gauze and is the so-called serum.

(17) Hog-cholera serum is, in reality, not a serum, but a defibrinated blood.

(18) One hundred c.c. of 5 per cent. carbolic acid solution is now added to each 900 c.c. of serum, to act as a preservative agent.

(19) The serum is now bottled and kept in a cool, dark place until ready for use.

Centrifuged Serum.—The hog-cholera serum, as just described above, is a dark-colored liquid of most unpleasing appearance. This is due to the presence in it of the large number of red blood-corpuscles or cells. In some serum plants in this country an effort is being made to overcome this objection by removing the red blood-cells. In the serum plant in Hungary this is being done, and the

serum turned out is of a clear, yellowish color, making a much more elegant-appearing product, and one that is much more conveniently handled.

In the United States the use of the centrifuged or clear serum has never seemed to meet with a great amount of general favor. There have been a number of objections raised to the removal of these red blood-cells. The most important of these, perhaps, is the fact that it materially adds to the cost of the process of manufacture. It is, accordingly, not regarded as advisable, in view of the fact that the price of serum is already so high as to in part hinder its use.

Another and even more serious objection has been raised, in that there is a possibility of decreasing the potency of the serum when we remove from it these same red blood-cells. No extensive experiments are on record as yet in this direction, but several observers have offered the suggestion that the germ-destroying antibodies may be in large part carried in the red blood-cells. This is a point worthy of serious consideration, although results with the use of other serums do not seem to bear out this theory.

For the present, however, the cost of removal of the red blood-cells is such as to make it inadvisable to add so materially to the expense of production by use of a procedure that is of questionable value.

Testing of Serum.—Before any batch of serum is sent out into the field for actual use it should be submitted to severe experimental tests on living shoats at the serum plant. This experiment is carried out in very much the following way:

First a number of pigs or young shoats are secured that will average about 60 to 100 pounds each. These are divided into several small lots of 2 each. In one lot of 2 an injection is given with 2 c.c. of virus blood and 15 c.c. of the serum. Another group of 2 pigs is injected with 2 c.c. of virus blood and 30 c.c. of serum. A third group of 4 pigs is injected with 1 c.c. of the virus alone.

In both the first and the second groups an injection has been given of double the usual fatal dose of virus blood. Under ordinary conditions this amount of the same blood would destroy the life of these animals in seven to ten days. If they are to be saved

it must be through the action of the serum which was injected at the same time as a protective agent.

With a potent serum these 4 pigs should all come through alive. In the 2 that received the dose of 30 c.c. of serum there should not even be signs of sickness. In those that receive the 15-c.c. dose of serum there may be seen some very mild symptoms of the disease. In these cases, then, we have a very good example of what these antibodies in the serum are capable of. Here, with an injection of only a few cubic centimeters of the highly protective fluid, we are able to save the life of the pig from an injection of double the usual fatal amount of virus. This is the basis which underlies the use of the double or simultaneous method of treatment.

The germs introduced with the virus and the antibodies carried by the serum wage a merry warfare in the body of the hog, and the result is not only a victory for the body, but the cells of that body are taught a new principle in defense. The antibodies introduced with the serum, seeing the need for more of their kind, quickly educate the cells of the body to manufacture antibodies for service in the battle for life. Once having learned the art of antibody manufacture, the cells forever retain this ability. This keeps a constant supply of the germ destroyers in the blood-stream, and leaves the hog with a permanent protective power or immunity to hog-cholera.

The 4 pigs that were injected with virus alone and receive no serum are intended as a check on the experiment, and are, accordingly, named "check pigs." The object of injection of these 4 pigs is to test whether or not the virus blood used really has any power of producing disease. If this was not done it could not be said positively whether the pigs given serum and virus would have become sick or not. Maybe they would not have been injured by the virus even if given no protective serum. This is conclusively disproved by the results in the check pigs. These checks are given only one-half the dose of the same virus, and yet they will be found to drop off feed about the evening of the fifth or sixth day. The effects of the virus when unchecked by serum are now shown.

In serum plants these check pigs are usually killed as soon as

they show well-marked symptoms of cholera and their blood drawn in the usual manner for use as virus for hyperimmunizing other larger hogs. This means a saving in expense, as by this means the same shoats can be used for checks and virus pigs. For this reason it is a good plan to use 4 check pigs instead of 2, and in nearly all serum plants the plan of using 4 check pigs is followed. This gives the same number unprotected as protected. Some men also give the same dose of virus to the check pigs as to those that are treated with serum.

This is the only real method of proving whether or not a serum is active in its power to protect against cholera. Every batch of

Fig. 67.—Dead check pig in serum test. Other pigs protected by serum remained healthy (H. K. Mulford Co.).

serum should be tested in this manner before being sent into the field, and any serum which is not capable of protecting the 100-pound shoat from a 2-c.c. dose of virus when given in dosage of 30 c.c., and even in dose of 15 c.c., should be rejected. In like manner, no virus should be sent out for use in the field unless it has been tried out on check pigs and found to be capable of producing the disease. It is absolutely necessary that both serum and virus be active if the desired results are to be obtained from the simultaneous or double method of treatment.

Preparation of Virus for Field.—Virus blood that is intended to be shipped into the field for use in giving the double method of

treatment is prepared in a slightly different manner from that intended for immediate use at the serum plant. This virus that is to be sent to the field is defibrinated the same as that to be used at the home plant, and there is then added to it 1 c.c. of 5 per cent. carbolic acid solution for each 9 c.c. of virus blood. In this way its keeping qualities are improved and it is prevented from early deterioration. This virus is then placed in glass-stoppered, dark-colored bottles and kept in a cool place until ready for use.

Virus Also to Be Tested.—Check tests should also be made on all virus used for hyperimmunization purposes at the serum plant. If the virus blood given at this time is of poor quality it will not produce the desired reaction on the part of the tissue cells of the animal into which it is injected. Failure to get this reaction would mean a poor quality of serum. For this reason it is advisable to test out the virus used at each hyperimmunization, in order to make certain that a virus has been injected that has sufficient disease-producing power to ensure a strong reaction on the part of the tissues and an accordingly large formation of germ anti-bodies.

By using a little tact these tests can be so arranged that the one series of tests serve to check the virus used for hyperimmunization and the serum intended for shipment to the field.

How Long May Serum Be Kept?—This is a question that sometimes arises. In case a large amount of serum is made during the winter months it is of interest to know if this product may safely be held over until the following summer and fall, and then used in the field. Most tests to date show very conclusively that this can be done with perfect safety. In fact, Dr. Niles, of the United States Serum Plant at Ames, Iowa, has shown that serum can be kept as long as a year and over without losing its strength.

The most important factor in the keeping of serum for several months in this manner before use is to keep it cold during all this time. If the serum is kept cold there is little or no danger of it deteriorating. It is a good plan, however, both at the time that the serum is made and at the time that it is about to be sent into the field, to have germ tests made by means of plate-cultures. This should be done by an experienced bacteriologist, and the presence of any large amount of germs would prohibit the use of the serum

in field work until it had been first thoroughly tested on test shoats to prove that the germs present were not capable of producing blood-poisoning and death of the animal.

In some plants they are also making these tests by injection of the serum into guinea-pigs, rabbits, and similar laboratory animals. These small pets are very easily affected by the germs of blood-poisoning, and quickly show the effects of their presence by severe reaction and even death. If an injection of the serum into their body produces no bad effects, it is not likely to in the hog.

How Long May Virus Be Kept?—This is a question which cannot be answered in the same manner as the similar question relative to serum. Virus blood contains a very unstable substance in the form of the virus of cholera, and to get a dependable reaction from this virus blood it is necessary that it be used as soon as possible after being drawn. It should not be used more than fifteen days after being drawn, and, preferably, should be injected within the first seven days after bleeding of the virus pig.

The opportunity for development of other germs in the virus is more marked than in the case of the serum. Hog-cholera is a disease that is often complicated by secondary infections of various types, and germs of these diseases may get into the virus in small numbers. The longer the virus is kept, the more these germs multiply, until they are soon present in sufficient amount to produce marked effects when injected. Virus bottles should be labeled so as to show the last date upon which the virus is to be used. After that date it should be destroyed by burning.

USE OF SERUM IN HOG-CHOLERA

We have seen in the preceding section that hog-cholera serum is a defibrinated blood obtained from hyperimmune animals as a result of tail bleeding. This fluid carries in it a large amount of germ-fighting substances, known as antibodies. These antibodies are capable, when injected into the body of a healthy animal, of defending that body from an attack by the germs of hog-cholera. We are now ready to take up the methods of using the remedy in actual warfare against hog-cholera.

In using hog-cholera serum in actual field work there are two principal methods of applying the remedy, both of which have

their advocates. As already mentioned in a previous section, these are known as the single and double or simultaneous methods. In the single method an injection is made with serum alone, while in the simultaneous method a dose of virus blood sufficient to produce death under usual conditions is given at the same time as the serum. In this manner the hog receives an actual attack by the virus of the disease, but is protected from ill effects by the accompanying use of the serum.

The **single method** will first be discussed, after which consideration of the double method and its advantages will be given. In the single method there is simply an injection of this protective substance, known as "serum," into the body of the sick or exposed animal, for the purpose of combating the disease if present or preventing its occurrence if it has not yet made its start.

The technic or method of administering serum is very simple, and yet there are a number of very important points to be observed if the best results are to be obtained.

In the first place, it is necessary to get the animals into some enclosed space where they can be caught conveniently and held while the serum is being injected. The best time of day for doing this work is early in the morning or late in the afternoon. In the hot weather of summer if heavy hogs are handled in the heat of the day they are liable to become overheated and die from heat exhaustion. Many such deaths are blamed on the serum, when, in reality, they are due simply to overheating by attempting to handle the hogs in the heat of the day.

With the hogs corralled in a suitable shed or small feeding pen, the next step is to get the serum and instruments in readiness. Some spot should be selected, if possible, where the work can be done away from the sun. Get on the shaded side of the barn or under a shade tree if possible. This protects the serum from exposure to the rays of the sun, and is also conducive of comfort to the operator and his assistants.

The serum should be brought to the farm in the glass-corked, paraffin-sealed bottles, and the seal should not be taken off the bottle until ready to begin work. A table should first be improvised by taking a clean box and turning it bottom side up, or the top of a barrel may be used for this purpose. Over this should be laid

several thicknesses of clean newspapers, and over all a clean white cloth or large towel.

Outfit Needed.—The serum-injecting outfit is now arranged on this table. The outfit necessary for serum injection consists of the following:

(1) Hog-cholera serum.

(2) One 30-c.c. syringe—preferably of the all-metal type, so constructed as to be capable of being easily taken apart and sterilized by boiling in hot water.

Fig. 68.—Instruments and utensils used in vaccinating hogs by the Tennessee State Demonstration Station.

(3) Several long hollow needles for introduction deep into the muscular tissues,

(4) One small 5-c.c. all-glass syringe, intended for use in injecting virus when the double treatment is used.

(5) One enameled pint cup with hinged cover for holding the serum while syringes are being filled.

(6) One agateware pan for holding antiseptic solution, in which needles and syringes are rinsed as necessary.

(7) Small metal cup to contain virus blood.

(8) Glass graduate, 100-c.c. size

(9) Swine thermometer.

(10) Small glass and brush for application of tincture of iodin.
(11) Tincture of iodin.
(12) Liquor cresolis compound for disinfectant purposes.

The Method of Injection.—In injection of hog-cholera serum the first important point is to properly secure and restrain the animal. The manner of doing this will differ somewhat, according to the size of the hog to be injected and the location where the injection is to be given.

Fig. 69.—Injecting serum into the muscle of ham. (Photo by Dr. Geo. R. White.)

If pigs and small shoats are to be injected the best plan is to simply catch the animal, and, grasping it between the knees, hold it head downward. This brings the hind legs about the level of the waist, and one leg can be securely held by each hand. In starting to inject a number of shoats averaging 40 to 100 pounds three or four assistants should be on hand. One man goes into the shed or feed lot, catches the pigs, and hands them out to a man on the outside. This assistant holds the shoat in the manner described.

Sufficient of the liquor cresolis compound is now poured into a bucket of water to make a 2 per cent. solution, and the inner sides of the thighs are thoroughly washed with this solution by means of a sponge or clean cloth. The favorite point of injection

Fig. 70.—Method of holding small shoat for injection of serum. (Photo H. K. Mulford Co.)

of the serum in these smaller shoats is deep into the muscles of t inner surface of the thigh. At the spot where the needle is to inserted the skin is touched with tincture of iodin and all is n ready for the injection.

Before giving the injection the temperature of the hog shou

be taken, to determine whether or not there is any evidence of commencing cholera. This is done by introducing the swine thermometer into the rectum. Normally, the temperature of a hog will be found to be from about 102° to 103° F. As a result of the excitement incident to catching and holding them, the reading is more likely to be nearer 103° than below 102° F. If cholera be present the thermometer will run high, and any case showing a rise above 104° F. should be regarded as suspicious. In the cases that show above 104° F. the serum alone should be given and should be administered in large dose—even double that usually advised for animals of the same weight.

The animal having been caught, restrained, the skin cleaned with a disinfectant solution and touched with iodin, and the temperature taken, the next step is to estimate the dose of serum to be administered. This is figured on the basis of live weight of the animal. The average dose of serum used varies somewhat with different practitioners, but in a general way the average dose given is as follows:

	c.c.
10- to 25-pound pigs	10
25- to 50-pound shoats	15
50- to 75-pound shoats	20
75- to 100-pound shoats	25
100- to 125-pound hogs	30
125- to 150-pound hogs	35
150- to 200-pound hogs	40
200- to 250-pound hogs	50
All hogs weighing over 250 pounds	60

In those cases where a high temperature is present, indicating the presence of an oncoming attack of cholera, it is a wise measure to practically double this dose of serum. While the advocates of the serum method of treatment do not claim any therapeutic power for the serum, it is nevertheless proving to be of active aid in this direction. In the United States Bureau of Animal Industry experiments now being carried on reports of a most encouraging nature are being received. In like manner, state and private investigators are finding that with the large dose of serum even sick animals can be saved. This, of course, does not hold good in all cases. Where the disease has got a good foothold, and the

animal is already running a temperature of 107° to 108° F., it is not of much use to give serum. If the hog is a valuable one, however, it is worth the chance, and most surprising results will often be noted.

Fig. 71.—Another method of holding small shoat by means of a trough (H. K. Mulford Co.).

I remember injecting a herd of hogs near Hustonia, Mo., in which nearly every hog in the herd of over 100 showed a high fever on the morning of treatment. Some of these ran as high as 108° F. Large doses of serum alone were given, and the results were most pleasing. Only 2 hogs were lost after the treatment

was given. In this case there can be no question that but for the use of the large amounts of serum over half of the herd would have been lost.

Having estimated the weight of the animal, the proper dose of serum is poured into the graduate. The top of the syringe is unscrewed and the serum poured in, the top replaced, and all is ready for injection. It is hardly necessary to add that before starting out with this outfit it has been thoroughly cleaned and sterilized by boiling. With the glass-barrel syringe it is not necessary to unscrew the cap, as the tip of the syringe can simply be placed in the cup of serum, and, by drawing up on the piston, the syringe barrel filled. Glass-barrel syringes have the disadvangage that they stand boiling poorly, and for this reason are hard to keep sterile. They are used, however, by a large number of men doing this work on account of their greater convenience.

Style of Needle.—The needles to be used in this work should be of the long, hollow type, especially suited to deep intramuscular injection. They should be sterilized by boiling, oiled, and kept open by means of a small wire plug in their hollow lumen. The points should also be frequently ground in order to keep them in good working order. These needles should be of medium weight, as the long delicate ones often break off when inserted deep into the tissues.

With the proper dose of serum in the syringe, the next step is the actual injection of the fluid into the deep muscles of the animal. This is done by simply plunging the needle deep into the tense belly of the adductor muscle, which stands out beneath the skin on the inner surface of the thigh. When the needle has been entered deeply into the tissue of the muscle, its contents are slowly forced out by pressing down on the piston. All the serum is given at the one spot and without withdrawing the needle. Care should be used to avoid striking the bone.

The needle is now quickly removed, taken off the syringe, and dropped in a pan of 5 per cent, disinfectant solution to remove any dirt or contamination that it may have received. By having several needles on hand and a couple of syringes it is possible to work very rapidly and use a clean needle and syringe at each injection.

With the proper number of assistants these small hogs can be handled very rapidly, and 30 to 50 injected in an hour. Thoroughness is, however, of far greater importance than haste, and plenty of time should be taken to see that every part of the work is thoroughly done.

After the pigs have been injected they are turned loose and allowed to run. The serum has no bad effects, and the hogs need no extra care following its use. There are a few points of importance that will bear mention at this point.

Fig. 72.—Showing method of "snubbing" large hog for injection of serum. Serum injected into muscles of ham. (Photo by H. K. Mulford Co.)

The next morning after the injection has been given the shoats will all show up stiff and lame, and the owner might be led to the belief that they were sick with cholera. This is not the case at all. The shoats are simply stiff in the hind limbs on account of the swelling and tenderness produced at the point where the serum was injected. This large amount of foreign material placed in the tissues is sufficient to produce quite a severe local reaction. This naturally causes the hogs to be stiff and sore for a few days. They soon warm out of this lameness, and after a few days it entirely disappears.

If there has been any carelessness or uncleanliness in the handling or administration of the serum there is a probability of abscess formation. These abscesses are one of the most common complications after injection of serum, and the utmost care and cleanliness is necessary to avoid them.

After-care of Animals.—For the first twenty-four hours after administration of the serum the hogs should be kept in a clean feed-lot or a meadow pasture and fed but very little food. They should be kept out of the sun as much as possible and allowed plenty of water for drinking purposes. It is a good plan to let them rustle for their food for a day or two. In this manner they move about rather freely, and this promotes good absorption of the serum and at the same time works out the soreness.

There should be no surgical operations of any kind performed on the hogs for several weeks. No ringing, snouting, or castrating should be done for at least three weeks. Immediately following the injection of the serum there is a considerable amount of reaction on the part of the tissues of the animal body. At the same time, if the hog be attacked by a swarm of cholera germs, there is a further drain on the strength of the tissues, and every energy is bent toward the defeat of the invading enemy. Every ounce of strength is necessary to carry out a successful fight.

Avoid Castrating.—If we castrate or ring the herd about this time we add an extra burden to the already overworked system, as the pain and inconvenience of these operations are bound to lower, to some small extent at least, the resistance of the tissues. This may be just enough of an added load on the tissues to throw the balance of power in favor of the germs.

I remember of one instance in Illinois last summer where a herd that had been exposed to cholera was given an injection with serum. The animals went along just fine for about ten days. The owner then castrated a number of young boars in the bunch. Two days later 3 of these castrated hogs were noticeably ill, and 1 of them finally died. All the other shoats remained well and thrifty. In this case there can be but little doubt that the castration was the cause of the change in condition of the 3 mentioned.

It is well also to cut down the feed pretty low for these first twenty-four hours. The hog is better off with little or nothing to

digest. It needs all the strength that he possesses to carry on the fight against the germ invaders. In the case of the simultaneous treatment this starving for the first twenty-four hours is very important, and will materially make for better results.

It is very important during these first few days after injection to keep the animals as much as possible away from mud-holes, insanitary hog wallows, and manure piles. Such dirt and filth can have only one result. It is bound to cause the development of a large number of abscesses from entrance of dirt into the puncture wound left by the needle. Keep the animals in a clean feed lot and a large number of these abscess cases will never develop.

Fig. 73.—Injection of serum into ham of large hog. (Photo by Dr. Geo. R. White.)

Treatment of Abscesses.—In those few cases where an abscess does follow the injection of serum all that is necessary is to again catch the animal, make a good free opening into the abscess sac with a sharp, clean knife, and allow the pus to escape. This pus should be received on cotton or old cloths and these immediately burned to destroy the infectious germs. After the pus has been squeezed out it is a good plan to paint the inside of the abscess with a strong tincture of iodin.

It is a very poor plan to let these abscesses run along and burst of their own accord. It is a better plan to open them up with a clean knife if it becomes necessary. In this manner the scattering

of pus and germs all over the feed lot is avoided, and, in the case of suckling sows, a large number of mammary abscesses will be averted.

Other Points for Injection of Serum.—The deep intramuscular injection of serum on the inner side of the thigh has many advantages, but it also has some disadvantages. One of the most important of these, from the standpoint of the butcher, is the formation of a deep abscess in the ham. The hams are the most valuable part of the dressed pork carcass, and if these are ruined by formation of abscesses it will mean a great loss to the packing companies,

Fig. 74.—Showing injection of serum behind the ear in large hog. Note manner of holding the hog. (Photo loaned by H. K. Mulford Co.)

and indirectly also to the farmer, for the packer will necessarily have this possible loss in mind when buying the live animals.

Behind Foreleg.—For the past two years the packers have been howling long and loud against this form of injection of serum, and advocates of serum treatment have earnestly tried to find other means of introducing serum into the body without producing these bad after-results. For this purpose other locations have been tried, and the result has been that we have two other locations where serum can be given with almost equally as good results as when given in the region of the thighs. One of these is by injec-

tion of the serum beneath the skin of the loose fold extending from the inner side of the front leg to the chest-wall. Serum can be administered here with comparatively little danger of abscess formation, and, if an abscess should form, it is in the loose connective tissue, and is easily trimmed out without the loss of any great amount of valuable meat.

Back of Ears.—Another point for injection of serum that meets with considerable favor among users of this line of treatment is to inject the product in the loose tissues behind the ears. This is an easy method of giving the treatment and one that is continually meeting with more and more favor. This location is especially

Fig. 75.—Injecting serum behind shoulder (large hog). (Photo by Dr. Geo. R. White.)

advantageous in giving the treatment to large boars and pregnant sows, as the injection can be made at this point with a very small amount of handling. In giving the serum in either of these locations it is advisable, perhaps, to give a little larger dose than that given when injection is made into the muscles of the thigh, as absorption probably is not so good from the connective tissues as from the muscles of the thigh.

Orchitis in Boars.—Another objection to the use of the intramuscular injection in male hogs is the fact that in boars, if a severe inflammation follows the injection of the serum, the swelling may spread up the perineal region and involve the scrotum and produce inflammation of the testicles. This very frequently leaves the animal worthless for breeding purposes.

Handling Large Hogs for Injection.—In handling large hogs for injection of serum it is not possible to hold them in the manner just described for pigs and small shoats. The hog is caught, thrown on the ground, and held on his back by one or two assistants. The skin is then cleaned, either on the inner side of the thighs, inside the foreleg, or back of the ears, and the serum injected with the 30-c.c. syringe, as previously described.

Fig. 76.—Injecting serum behind ear of large hog. (Photo by Dr. Geo. R. White.)

In large hogs, where it is necessary to use more than 30 c.c. of serum, it is advisable to use a clean needle with each injection, and it is often a good plan to use more than one site for injection. For instance, 30 c.c. can be given on the inner side of one front leg, and the other 30 c.c. back of the ear, on the same or the opposite side, or in the thigh.

Where the double treatment is being given, it is advisable to give the serum on one side and inject the virus on the opposite side. This will be again mentioned under the head of Double Treatment. Never mix serum and virus before injection.

There is another method of handling old hogs for the purpose of injecting serum that offers about the best results, especially in boars and pregnant sows. This is to snub the animal up to a post or tree by means of a rope with a loop in the end of it. This loop is thrown gently over the nose and slipped into the mouth, so as to get the loop around the upper jaw and back of the tushes. It is then drawn up quickly, and one or two wraps taken around the nearest post, tree, or other firm support. The hog will almost invariably pull back and keep the rope taut. In this manner the hog can be held for injection of serum back of the ears. The position is excellent for this purpose, and this manner of restraint avoids any possible difficulty in handling old boars, and also very much lessens the danger of producing abortions in piggy sows.

One objection is made to this injection back of the ear, and that is the possiblity of getting an occasional diffuse spreading inflammation of the neck, which, by causing a severe swelling of the tissues of the neck, might choke the animal to death. Some few cases of this kind have been reported, but they are only a very small percentage of the total number so treated.

Abortion Following Use of Serum.—The question may often be asked what is the danger of producing abortion in piggy sows by the use of serum? In my opinion, with careful handling, there is practically no danger at all. Abortions following the use of serum in pregnant sows are due in almost every case to improper and rough handling during the time of treatment. By snubbing the sows up with a rope in the mouth, and giving the injections in the loose tissues back of the ear, there is very little or no danger of causing abortions. Dr. Fitzgerald, of Ohio, reports on a large number of cases where piggy sows were serum-treated without any higher percentage of abortions than might be expected under normal conditions. This holds true with almost equal certainty in either single or simultaneous methods of treatment.

In a few cases, where the animal is already suffering from a high temperature at the time of injection, abortion is very likely to follow, as the hog is at that time suffering from hog-cholera, and will slip the pigs as a result of the high temperature associated with the disease, even though it be aborted by the use of hog-cholera serum.

Indications for Single Treatment.—The question now naturally arises as to the indications for use of the single method of treatment. These are briefly as follows:

Some men are unalterably opposed to the use of the double treatment. These are usually persons who do not thoroughly understand the principles upon which the double method is founded. They have, perhaps, had a bad experience with this form of serum management through use of a poor quality of serum. In other cases, they have got the idea that use of double treatment will permanently infect their premises. In all these cases, after a reasonable amount of argument has failed to show the owner that the double treatment would be of more advantage in his herd, it is better to allow the use of the single method, if so desired, rather than not use any serum at all on this farm.

In herds that are about to be placed in exposed feed lots the use of the single treatment at the time they are turned into the feed lot will often be all that is necessary to protect them from the disease. For at least six weeks they will all enjoy a complete protection from cholera if the serum used be of proper quality. At the end of this time the effects of the serum begins to wear off, and unless enough of the germs have been met with to set up a reaction on the part of the tissue-cells themselves the animals may again become susceptible to hog-cholera. The use of the double treatment in these cases is more advisable, as it is equally or even more safe, and, at the same time, is much more positive in its final outcome. By injection of the virus we make sure that every hog receives his allotted dose. When simply turned into infected pens they may all come in contact with the virus, or, on the other hand, one or two may entirely escape the virus and be left unprotected at the end of six weeks.

In herds that are in the same pens with or on an adjoining pasture to those that have cholera the single treatment is often advised as preventive of further spread of the disease. In this connection it is usually successful in nearly 100 per cent. of cases. However, in these exposed herds I think the best plan to follow is to take all temperatures, and give the single treatment in all animals with a temperature of 104° F. or higher, and the double treatment in all that show a temperature below 104° F. In this

manner a permanent immunity is assured to every animal in the herd. Otherwise, some of the healthy hogs may never take up enough of the virus to produce a reaction and, as a result, are only temporarily protected.

In very young pigs the double treatment is not overly advisable, as these little fellows do not seem capable of taking up the work of antibody formation. Giving of the double treatment does not in itself do any harm to the little pigs, but it very often does not give a permanent immunity unless the pigs be at least six weeks of age. The better plan in small pigs, then, is to give the single injection when a few days old if cholera threatens. In case there is no close outbreak of the disease it is as well to wait until about weaning time and then administer the double treatment. In case the single treatment is given to very young pigs, it is advisable to follow this later on with the double injection, giving the treatment again at the age of about six weeks.

In pigs that are born of an immune sow there is a temporary immunity which seems to last for several weeks. In such pigs it is not necessary to give any treatment until they are about six weeks of age, and then the double injection is the more advisable.

DOUBLE OR SIMULTANEOUS METHOD OF TREATMENT

We have seen, in the preceding section, how we may make use of the serum alone as a weapon in our fight against the disease hog-cholera. This serum alone, when injected into the body of a healthy animal, supplies it temporarily with sufficient of the antibodies, or germ fighters, to keep it free from the disease, and enables it to withstand the attack of almost any number of the disease-producing germs.

This immunity, however, we found was only temporary in nature, and passed off in about thirty days or a little over. This would make it necessary for us to treat the animals with serum about every six weeks during seasons when cholera is present throughout the entire summer, as is often the case, and, in the end, it would make the treatment too expensive to be of value.

In the case of animals that are to be fattened and got ready for market this period of six weeks during which they are protected might be enough to complete the fattening process,

and get them off to market before the protection given them by the serum had run out.

On the other hand, in the case of sows and boars that it is desired to keep over for another season as brood stock, it would be much more desirable if the treatment could be so arranged as to make one injection sufficient to give protection throughout the lifetime of the animal. This is just what we are able to do by means of the double treatment.

In discussing immunity we found that immunity was a resistance to disease, or protection against disease, which was developed as the result of an actual attack of the disease, or might be given by injecting into the body of the animal some substance which carried with it bodies that would protect the animal against the special disease from which immunity was desired. Now an actual attack of cholera is usually fatal, and if we were to depend upon protection obtained in this way we would have very few immune animals, as most of them would die during the attack of the disease.

It has been found, by careful experiments, that we can take the pure virus of cholera and inject it under the skin or into the muscles of an animal and produce a fatal attack of the disease within a week. An example of this is seen in the manufacture of serum where young shoats are injected with virus blood and allowed to get sick, and are then slaughtered just before they die of the disease, in order to get the virus blood necessary to inject immune hogs to produce a hyperimmunity that will give us a blood from which serum may be made.

If we take the same dose of virus which we inject into these unprotected pigs and give it to an animal that is protected by an immunity resulting from an attack of the disease, there are no symptoms produced. Even a thousand times the usual death-producing dose of virus we find only stimulates the development of more immune bodies in one of these protected animals.

We have also seen that if an animal be given a dose of serum and placed in the same feed lot with sick cholera hogs the protected hog will not develop the disease.

Now we can go even a step further, and find that if we inject a dose of the cholera virus and at the same time inject into the animal a sufficient dose of a good strong serum, the animal will

not get sick. If this same animal were given this same dose of virus without the serum he would die within ten days. Giving the serum with the virus enables the animal to escape the disease.

The virus germs that are introduced into the body in the giving of this so-called double or serum-virus simultaneous method make an attempt to cause an attack of cholera, but the germ-destroying bodies in the serum are too active, and the hog-cholera virus is destroyed before it is able to get in its work.

While the battle is being fought between the virus and the germ destroyers contained in the serum the cells of the body learn their lesson, and they become educated in the matter of producing these germ fighters. Just as a nation which begins a war without a navy has to call on some other nation to loan them war vessels. This nation learns the need of a good navy, and at once sets about to build ships of its own. So the cells of the hog's body, learning the need and usefulness of these germ-fighting ships, begins to produce them on its own account, and once it has developed the knowledge of how to produce these germ destroyers it keeps a supply of them always on hand.

The result of the knowledge gained is that the body of this hog is always in a position to keep up a strong fight against hog-cholera, and the germs of this disease will never again be able to gain entrance and set up an attack.

This is, in brief, just what takes place when we give the double treatment. We not only protect the animal against the disease, but we also send into the body teachers which show the cells of the animal how to produce germ fighters of their own which will enable them to always be prepared for another war against these same germs. In other words, the immunity or protection gained is permanent and lasts as long as the animal lives.

Numerous experiments have been made by Drs. Dorset, Niles, Fitzgerald, and many other investigators in this field, which all go to show that the protection derived from the double treatment is lifelong. This is a great advantage over the results which follow the use of the single or serum-alone method of treatment. We found that the protection given by this method was only temporary in nature, and that it disappeared at the end of thirty days, or six weeks at most. Here we have a method which

can be used at practically the same expense, and which gives a protection which will last as long as the animal lives.

There is one possible exception to the statement that immunity produced by the double method is lifelong. This is in the case of young pigs. Young, sucking pigs, when injected by the double treatment, often prove to lose this protection later on in life. This is probably due to the fact that the cells of the body are so young and imperfectly developed at this time that they are not in a condition to take up permanently the work of forming germ fighters or antibodies. Just as a young child or a young animal forgets the things that it learns in its early childhood unless they are constantly practised, so the cells of the body of these young animals seem to lose the knack of manufacturing the germ fighters as they grow older. This can be overcome by treating again a little later on in life, say, at the age of three months.

HOW DOUBLE TREATMENT IS GIVEN

In giving the double treatment it is necessary to make use of both serum and virus blood. This is how the treatment gets the name of double treatment, there being a double injection made of serum and virus. These two injections are made at the same time, and on this account it is sometimes known as the "simultaneous" treatment.

Source of Virus Blood.—It will be recalled that virus, or virus blood, as it is more properly called, is the blood which is obtained from the body of the sick animal when the disease is well advanced and the animal in practically a dying condition. This virus blood has already been described, as have also the methods by which it is drawn.

Virus blood which is intended for use in the field for giving the double treatment is handled in just the same manner at the serum plant as that which is intended for immediate use in hyperimmunizing animals from which serum is to be produced. The blood is drawn in the same manner, and shaken and strained to remove the fibrin which would cause clotting if not removed.

Carbolized Virus.—The only difference in this virus blood and that used for hyperimmunizing at the plants is that a small

amount of a solution of carbolic acid is added for the purpose of keeping it from spoiling until ready for use. The amount added is about the same as that used for keeping the serum; that is, to each 9 ounces of the virulent blood one ounce of a 5 per cent. solution of carbolic acid is added. This small amount of carbolic acid is sufficient to enable one to keep this virus blood for several days if handled properly, and still is not enough to do any harm to the animal into whose body it is injected.

Virus is put up in smaller bottles than the serum and is properly labeled to avoid any mistake. Otherwise, in general appearance it is very similar to serum, being perhaps a little lighter in color as a rule.

Virus blood, unlike serum, will not hold its strength for an indefinite period. We have found that serum can be kept for almost any reasonable length of time, and still prove to have the power of protecting the animals into which it may be injected against an attack of cholera. Virus blood, on the other hand, must be used very soon after it is drawn from the sick animal if we are to obtain the best results from its use. The sooner it can be used the better, and under no conditions should it be used after it is more than fifteen days old. When putting up virus blood, manufacturers label the bottles not to be used after a certain date. This is the date after which it becomes unsafe to make use of the virus, and, if it has not been used at this date, it should be destroyed by burning or other safe method.

Method of Injection.—In giving the double method of treatment to a herd the work is done in just the same manner as for the single method, with the exception that a dose of the virus is also injected at the same time the serum is given.

The animals are caught and securely held, as in the case of the single treatment. All the instruments are carefully cleaned and boiled, and for this method we also prepare the small syringe previously mentioned, which is intended for use in giving the virus. The animal is scrubbed with the disinfectant solution, and the skin in the region where the needle is to be inserted painted with tincture of iodin. The large syringe is filled with serum, the weight estimated, and the temperature having been already taken the proper dose of serum for the weight of the animal is now injected

either in the muscles of the hind limb or in the loose tissues back of the ears or behind the foreleg.

We are now ready to inject the virus. The dose of virus is much smaller than that of serum, and runs from a few drops to $1\frac{1}{2}$ c.c., according to the size of the animal. The correct amount of the virus is now measured out, placed in the small syringe, and injected in the opposite side from that where the serum was injected. For instance, if the serum is injected into the muscle of the right hind leg, the virus should be given in the muscle of the left leg; while, if the serum be given behind the left ear, place the virus under the skin behind the right ear.

The skin at the point where the virus is to be injected should be just as carefully cleaned and painted with tincture of iodin as in the case of the location where the serum is to be injected. At every step in the process cleanliness must be the watchword. This will prevent many abscesses, many cases of blood-poisoning, and other bad effects which are often blamed on the serum, when, as a matter of actual fact, carelessness and lack of attention to little points of importance is the cause of poor results.

Do Not Mix Serum and Virus.—I have seen cases where men injecting the serum and virus treatment simply mixed the virus and serum together, and injected them both in the one place and with the one syringe. This is not a proper method and should not be followed. Give serum with the large syringe, and use this syringe for no other purpose. Give the virus with the small syringe, and use this instrument for this purpose only. Give the injections at different points, and do not inject both serum and virus in the one location. If a large dose of serum is needed on account of the size of the animal, and it is necessary to use the space back of both ears for the purpose of injecting same, then inject the virus in some other part of the body, such as back of the foreleg or in the muscle of the hind leg.

Dose of Virus.—The dose of virus blood is, of course, very small. It is to be remembered that this virus blood is, in fact, a pure culture of the hog-cholera virus or hog-cholera germ, and only a few drops of it would be necessary to produce the disease in such a severe form as to cause death. However, when injected with the serum, a little more can be used without danger, as the germ-

destroying bodies in the serum will attack the disease germs in the animal and destroy them. It is desirable to inject enough of the virus to give a good stimulation to the cells, and in this manner start up a free manufacture of these same germ-destroying bodies to which the animal will owe its power to keep free from cholera for the balance of its life.

As in the case of the dose of serum, the dose of the virus blood will vary somewhat with the age and weight of the animal. The following figures are about the dose in which the virus is given by the leading serum men of the United States:

	c.c.
10- to 25-pound pigs	¼
25- to 50-pound pigs	½
50- to 75-pound shoats	¾
75- to 100-pound shoats	¾
100- to 125-pound shoats	1
125- to 150-pound shoats	1
150- to 200-pound hogs	1½
200- to 250-pound hogs	1½
All hogs over 250 pounds	1½ to 2

Dangers of Double Treatment.—This is a question which is very commonly met with in the use of the simultaneous method of treatment. Is there any danger in the use of this double method of treatment? This question is often asked, as farmers have in some instances found that the use of this method of treatment has been followed within about five days by a very severe outbreak of cholera in their feed lots, with a complete wiping out of the entire herd within a week or ten days.

If this were to occur after the use of the simultaneous method it would surely be a most undesirable outcome, and one which would reflect very disastrously upon the veterinarian or others who had given the serum.

I have investigated a number of these reported bad results following the use of the double method of treatment, and in almost every case I have found, when the matter is traced to the bottom, the real cause of trouble has been either that the treatment was not properly administered or the serum used was of a questionable character.

I investigated one case, for instance, where the farmer had given the treatment himself, and where virus alone had been administered and the serum not administered until the animals began to get sick from the use of the virus. In another case equal parts of virus and serum had been given, and in any number of cases serums had been used which were of questionable strength and not of tested power to prevent the disease.

If you are going to use a cheap and untested serum, use it by the single method only. You may be lucky enough that the herd in which it is given will not be exposed to the germs of cholera, and in this case, if the serum is not too dirty, you will be able to get through with no bad effects, although you have actually done no good.

When you decide to give the double method of treatment you must be absolutely sure of your serum. You are placing in the body of the animal a dose of hog-cholera virus which will most certainly produce cholera and kill the animal within two weeks at most if not properly protected by a powerful serum. The results of the double method of treatment depend absolutely upon the quality of the serum, and no serum should be used in applying the double treatment unless it has been previously tested against the virus in the living animal, and found to have the power to protect from bad effects when doses of 2 c.c. of the virus blood are used.

If this precaution is taken to ensure a perfectly reliable serum there is absolutely no danger of bad results in a herd in which the double treatment is used. In the United States Government experimental work in the states of Iowa, Indiana, Missouri, and Nebraska the simultaneous method of treatment has been made use of very largely, and the results have been uniformly pleasing. No outbreaks of cholera have occurred in animals that have been given this method of treatment, and no deaths have been traceable to this cause.

In order to ensure a permanent immunity as a result of this method of treatment it must be made sure of that the virus blood used is really capable of producing disease. Remember that it is due to the action of this virus blood that the cells of the body take up the work of manufacturing germ-destroying bodies, and in

this way become a source of protection to the animal against any future attacks of hog-cholera.

It has been reported that serum makers who were putting out a questionable grade of serum have in some instances sent out what was supposed to be virulent blood, which was not taken from a sick animal at all, but was simply blood from a healthy animal, and in some cases was even reported to be nothing but serum placed in virus-labeled bottles. It is, of course, easy to be seen that the use of a "virus" of this nature could not produce any good results. Fortunately, it is not likely to produce any direct harm, but does result in harm later on when the animals may become exposed to cholera. Animals which had been treated with a virus which was of no account would, of course, only have a temporary protection, and they might later on take the disease. Such cases as these have led to wrong opinions being formed regarding the double method of treatment.

It can be put down as an absolute fact that if the serum-simultaneous method of treatment is properly given by a competent veterinarian, with a tested serum and a virus which is known to be capable of producing the disease, immunity will be developed, and that immunity will last as long as the animal lives. Not only this, but there is practically no danger whatever of the animal developing an attack of cholera as a result of the administration of the virus blood when accompanied by the proper protective dose of the virus.

Not only will animals so treated develop the power to overcome an attack of cholera, such as they might meet with by exposure in pens that had become infected with cholera germs, but they will be able to withstand the attack of one thousand times the fatal dose of hog-cholera virus, even if it be injected directly into the veins of the animal, as in the process of manufacture of hog-cholera serum.

The absolute absence of bad results following the use of these enormous doses of pure virulent blood in the serum plants is the best possible proof of the effects which follow the use of the double method of treatment. Almost all the large serum plants get their supply of immune hogs by taking unprotected or susceptible animals and injecting them with the double method. Thre

weeks later these same animals are injected with one thousand times the dose of virus which would have killed them before they received the double treatment. As a result of the protective power which these hogs have developed they are now able to receive this large dose of germ-bearing blood, and they show no bad effects from it. As a further proof of the protection which these animals have gained, they can be taken and placed in feed lots with hogs which are sick with cholera and they will not take the disease. Such proofs as these leave absolutely no question as to the benefits to be derived from the double method of treatment.

This is the method of treatment that every well-educated and competent veterinarian and stockman in the United States should advocate. It is just as safe as the single method when used by an educated man who understands the nature of the serum and virus which he is using, and when he is handling a serum and virus both of which have been thoroughly tested.

How Virus is Tested.—At the same time that the serum is tested the virus should also be tested. This is done in the following manner: 4 pigs are taken, and 2 are injected with 1 c.c. of virus alone, and receive no protective dose of serum. The other 2 receive the same dose of the virus or, better still, 2 c.c. of virus and a proper protective dose of serum, according to their weight. Ten days later the pigs which have received the virus alone should begin to show signs of cholera, or may even be dead if the virus used be of the very powerful variety, such as is used in the Bureau of Animal Industry serum plant, where check pigs are usually killed within six or seven days. The pigs which received the virus and a protective dose of serum at the same time should show no bad effects at the end of ten days nor at any time following the injection. These tests should be made at the serum plant, and no serum or virus should be allowed to leave the plant until it has been so tested and proved to be just what it claims to be.

Immunity in Litters.—Not only does the simultaneous method of treatment give a protective power against cholera to the animal so injected, but, as has already been mentioned, it gives the animal the power of transferring to a limited extent this protection to its young. The litters born from sows that have received the

double treatment are usually able to withstand any ordinary exposure to cholera during the first few weeks of their life. The protection so given usually lasts until about weaning time of the pigs. Dr. Dorset, of the United States Bureau of Animal Industry, and Drs. Fischer and Fitzgerald, of the Ohio State Experiment Station, report a number of cases in which they have taken these pigs born from sows that had been protected by the double method of treatment and injected into their bodies the usual death-producing dose of hog-cholera virus. These pigs were not in the least effected by the virus. Other pigs, which were born from sows that had never been treated when injected with the same dose of the same virus, were killed.

Pigs from these same litters, after being weaned, were again injected with the virus blood and proved to be unprotected, cholera appearing in the usual length of time. The type of the disease which appeared even at this time was of the slow or chronic type, showing that the animals still had some protective power against the disease.

This protective power which the sow gives to her litter is probably, in part at least, due to the milk. The milk is a secretion which is derived in large part from the blood. The blood of these sows contains a large amount of the germ-fighting bodies, and it is highly possible that this milk carries with it a certain number of these same germ destroyers. For the young pig the dose of serum necessary to protect against cholera is very small, and it would require but a small number of these antibodies or protectors to keep the animal free from the disease. However, as in the case of the use of the serum-alone treatment, there is nothing entering the body of the little pig to educate the cells of his body in the manner of making these germ-fighting bodies, and, as a result, as soon as he is weaned from the mother he begins to lose his protection against the disease and becomes susceptible.

It is at this age that the pig should be handled and given the simultaneous or double method of treatment. At this age and weight the cost of the double treatment would be very small, only about 25 cents for each pig. Properly given, with a tested serum and a proved virus, the results can only be good. There is practically no danger of loss from the treatment, the expense

is moderate, and the protection against cholera which is given at this time will last throughout the lifetime of the animal.

These same pigs, if treated by the double method of injection, keep this protection for life, as just stated, and can, accordingly, be kept over for breeding purposes. The pigs which they will farrow the following spring will also have a temporary protection, lasting until they are about six weeks of age. It is very easy to figure from this what would be the final result if we were to follow this method of handling the disease. If every herd of pigs were double treated at weaning time, or even earlier in case an outbreak of cholera be present in the neighborhood, and only treated animals held over for breeding purposes, the result would be that it would be almost impossible for cholera to get a start in such a herd if we again treat the pigs farrowed by these immune sows just before they are weaned. This is the method of handling cholera which is being advocated by those who have the most experience with the serum methods of treatment.

Eradication of Cholera.—The single treatment is all right when there is an outbreak already on the premises, or even where the animals have recently been exposed to the disease. The double method, however, is the real method of treatment that is bound to produce the most desired results, namely, the driving of hog-cholera out of the country. All we need do is to extend this method of treatment to all the herds in the United States, and keep following it up for a few years, and there will be no cholera germs in the country to produce the disease. They will simply all starve to death from want of any animal which they can attack. The cholera germ or no other disease-producing germ can live unless it has victims to attack. By means of the double method of treatment we stock the farms with a class of hogs that are so protected against the disease germs of cholera that it is impossible for cholera to get a start with these animals, and, as a result, the cholera germ is without a place in which to keep itself alive. The germ may live outside the animal body for even as long as a year, but it cannot remain much longer than that time without it finds animals which it can attack and thus reproduce itself. It is not believed that the hog-cholera virus has the power of keeping up an existence for any length of time outside the animal body. It may persist in

feed lots in dark, damp corners, protected from sunlight, for as long as a year, but the virus must have an animal body to live in if it is to reproduce and keep up its power of producing disease beyond that length of time.

Care in Destroying Virus.—At the end of the injection of a herd of hogs there is frequently left over a small amount of serum, and perhaps a small amount of virus. The question is, What should be done with this unused serum and virus? Can they be used later on?

The answer to this question must depend somewhat upon the conditions. If another herd is to be treated the same day, or even the next day, the virus and serum, if kept cool, can be safely held over and used on the next herd. Opened bottles of serum should never be taken back to town, however, and kept to await the next call for treating a herd, which may not be for a week or more. The best idea is to gage your serum so that you will not have more than 100 c.c. at most left over, and this can be very easily used up by giving a little larger dose to the last few animals when you see that you have a little more opened up than you are going to need. It is not possible to do any harm by giving a little bit more of the serum. The greatest danger lies in cutting the dose short, and not giving enough to produce the results desired.

With the virus it is an entirely different matter. It is not advisable to increase the dose of virus above that given in the above table of dosage. Remember that this virus is the disease-producing blood itself, and it is capable of causing the death of the animal very rapidly if improperly handled. With a first-class serum there would be but little danger, even if larger doses of virus were to be given. It is not wise to do so, however, as there is nothing to be gained by it. The dose of virus mentioned above is plenty large enough to stimulate the cells of the body and start them to producing large numbers of the germ-fighting bodies, and this is what we wish to accomplish with the use of the serum-simultaneous treatment.

It is quite easy to estimate about the amount of virus that you will need for a given herd—in fact, much easier to estimate this fairly close than it is with the serum. If any of the virus be left over, do not, under any condition, throw it out on the ground, as I

have frequently seen done. Remember that this virus is exceedingly dangerous, and, while it can do no harm to the hogs that have been injected, yet if thrown on the ground of feed lots it causes these feed lots to become infected, and any hogs which may later on be brought into the lots would take the disease. There is another danger, too, from the scattering on the ground of this hog-cholera virus. It may be tracked on the shoes of some of the other men who are present to help with the work, and be carried by them to their feed lots, and prove to be the cause of starting an outbreak of cholera in their herds.

There are a number of cases reported where it is stated that the use of the double method of treatment has resulted in the infection of the feed lots, and caused an outbreak of the disease in unprotected hogs which were brought into these lots in the following year. This infection of the feed lots is blamed on the use of the double treatment, when, in reality, it is very frequently due to carelessness in disposing of the virulent blood that is left over after the treatment has been completed.

Cleaning of Syringes.—There is only one proper manner of disposing of this virus blood, and that is to destroy it by burning. In this manner the cholera germs are entirely destroyed and there is no danger of bad after-results. Also remember in cleaning the syringe used for injection of the virus that it contains some of this virus blood, and great care must be used to see that it is cleaned with some solution that will destroy these germs. As a final cleaning process the syringe should be thoroughly boiled in water to which some baking-soda has been added.

Reaction Following Double Treatment.—Following the use of the double treatment there may be slightly more of a reaction on the part of the animal injected than in the case where the single treatment is used. Following the single or serum-alone treatment about all the after-effect that was noticeable was a slight stiffness and soreness of the parts where the syringe was inserted. In the case of the double treatment there may be somewhat more of a reaction.

In using this double treatment we are injecting the hog with a good-sized dose of the cholera virus, and, even though protected by an accompanying dose of serum, it is not unusual to meet with a case where for a few days the animal will show some signs of being

sick. If the serum is of proper quality, and has been properly tested out at the serum plant before being shipped out, this sickness should only be temporary in nature.

There is a slight elevation of temperature, the animal may be a little off feed, and somewhat droopy. That is about all that will be noticed. This is not seen in all of the animals by any means. It may not be noticeable in any of them. In other herds one or two, or even perhaps a half-dozen, may show these signs of a strong attack by the virus of the disease.

These cases are to be explained by the fact that these animals are very easily affected by the germs of cholera, and, even when protected by serum, are inclined to show some effects from the attack of the virus. It is these animals that get sick first at an outbreak of the disease in a herd, and are dead almost before the owner realizes that there is anything wrong with them.

Question of Spreading Infection.—There are some very careful investigators with hog-cholera who are opposed to this double method of treatment. They base their objections on the ground that these double-treated hogs do actually go through a mild attack of the disease, and that the manure, urine, and other discharges contain the virus of the disease. They claim that these discharges cause an infection of the premises and prove the source of an outbreak of the disease the following year. In this manner they argue that where we only had a few infected feed lots this year, we will next year have a large number of them. This will mean a wider scattering of the disease and more cholera every summer than we had the year before.

Their point, however, I believe to be poorly taken. I know of no case where this has ever been proved to be the case. It is very doubtful if the discharges of these animals which receive the double method of treatment are really capable of producing the disease or infecting the feed lots. Especially is this true in those cases in which the animals do not show any bad effects following the use of the treatment. It is barely possible that where one or more animals show symptoms of a mild attack of the disease after the giving of the double treatment there might be infection of the feed lots.

Several experiments have been made along this line, and I

think that my opinion on this subject agrees with that of the majority of the men who are working in this line. Personally, I do not think that there is any danger whatever of this kind. It may be barely possible that an occasional feed lot becomes infected from this source, but, even granting this possibility, I am convinced that the benefits resulting from this method of treatment are so large as to more than overbalance any danger there may be from such a source. If we can develop large numbers of these immune herds which have a permanent protection against hog-cholera as a result of the giving of the double treatment we will soon make hog-cholera hard to find. The proper plan to follow after once having a herd treated by the double method is to never bring any hogs on the premises again unless they have received the treatment, and also inject the young pigs at the time when they are about ready to wean.

By following this method of handling the disease it is more or less unimportant whether the feed lots are infected or not. The disease cannot get a start in an immune herd, and the cost of treatment of an entire herd of sucking pigs is less than the value of one full-grown animal which might be lost in the late summer or early fall from an outbreak of the disease.

This question of infection of feed lots from the discharges of animals which have received the double method of treatment is an interesting one, however, and one which needs more careful study. The officers of the United States Bureau of Animal Industry, as well as the men employed in carrying on this work at the various state experiment stations, are working on field tests along this line at the present moment, and it should be definitely determined within a short time whether or not any danger does really exist from this source.

Personally, I regard this as a secondary matter. Even though it were proved that the giving of the double treatment did result in contaminating the feed lots with the feces containing hog-cholera virus, I would still favor just as strongly as I do to-day the use of this method of handling the disease. It is the proper method for controlling hog-cholera, and is bound in the course of the next few years to become just as popular among hog producers as is vaccination against small-pox among the human family.

There will always be found those who oppose any new method of treatment. Even as well proved as are the effects following the use of small-pox vaccination, yet there are thousands of people in the United States and in other countries who condemn vaccination, and insist that it is a means of spreading small-pox and other diseases instead of being a means of checking the spread of the disease. Some of them even go so far as to say that they are just as well protected against the disease without being vaccinated as their neighbor who has been treated with the small-pox vaccine. Every few years there grows up in certain parts of the country a considerable colony of these unvaccinated people. It is not long until small-pox sees the opening, and the result is a disastrous outbreak of the disease, with the result that a large number of lives are lost which could otherwise have been saved. A very good example of what we may expect in this line was seen a few years ago in the outbreak which occurred in Montreal, Canada.

In the city of Montreal a very strong opposition had grown up against vaccination. As a result, a large part of the population of the city were not vaccinated for a number of years, and these unvaccinated individuals laughed with scorn at those who made use of such a method of protecting themselves from the disease. Montreal went along without any small-pox for a number of years, and the advocates of no vaccination kept on increasing in numbers.

Finally, a negro porter, on one of the Pullman cars running from Chicago to Montreal, was taken sick while in Montreal with what afterward proved to be small-pox. When taken sick he was in a large rooming house or hotel. The disease rapidly took hold in this new locality. The hotel was closed and the guests allowed to scatter to different parts of the city. The disease, in this manner, was spread all over the city, and it rapidly took hold like a prairie fire before the wind. The result was one of the most frightful outbreaks of small-pox in the history of this continent. There were over 1000 deaths, and the lesson proved a most costly one to the people of this prominent Canadian city.

In the case histories which will be given in a following section several herds will be shown in which the double method of treatment was given, and where healthy animals were left in the pens unprotected by either single or double methods of treatment.

These animals did not get sick, and if the manure and other discharges from the injected animals were really capable of causing disease in the unprotected animals, it should have been shown in these herds.

Virus in Hands of Uneducated.—While I am decidedly in favor of the adoption on a much wider scale of the double method of treatment, I am not in favor of allowing this method of treatment to be given by those who do not possess the proper knowledge as to the character of the agents which they are handling. The man who has no instruction along this line is not in a position to realize what great possibilities for harm are carried by this virus blood, and is liable to handle it improperly. Virus should not be supplied to anyone, be he veterinarian, farmer, or stockman, unless it is first shown that he possesses the proper knowledge of the nature of this disease-producing blood, the dangers which follow any carelessness in handling same, and also that he understands how to properly administer the double treatment.

The development of the serum treatment of cholera is quite recent, and, while I am opposed to the handling of virus, or even of serum by the farmer unless he be specially instructed as to how to use the same, I do not believe that every man who bears the title of veterinary surgeon is capable of handling this serum-virus treatment intelligently unless he has visited some college in the past two years, or some reliable state serum plant, and received instructions in the handling of the virus and serum.

This is a duty which every practising veterinarian owes to his patrons. Every man who is practising in a community where hogs are raised should make it his business to take a few days and make a trip to some first-class serum plant, and become familiar with the process of manufacture of serum and with the methods for handling serum and virus. It will be time well spent, and will put him in a position to go out in the field and handle the agents with every confidence in the correctness of his methods of doing the work, and also with every confidence of obtaining the best results.

Good results cannot be expected where the serum is not properly used. Especially will this be the case where the double method of treatment is made use of. A great amount of damage has been done already, and public confidence, both among the profession

and among the stockmen, destroyed by improper use of serum and virus. First, make sure that you have a reliable quality of serum, a good grade of virus, and then, if you are capable of giving the remedies correctly, you cannot fail of having good results.

The outlines given in this book for guidance in the using of these methods of treatment are sufficiently clear that any man, who has had the benefit of an education in a veterinary college or a state agricultural college in recent years, should have no difficulty in obtaining a clear understanding of every step of the process and the scientific basis which underlies each step of the work. However, a trip of a day or two to one of the large serum plants will give him an actual insight into the methods of preparing the serum and the manner of using same that will more than repay him for the time and money spent in making the visit.

Which Method to Choose.—The two principal methods of using hog-cholera serum have been very carefully discussed, and it is now time to consider the question, When should the single method and when should the double or serum-simultaneous method of giving serum be used? This is a very important one, and one that must necessarily be settled before commencing work on each individual herd. The conditions surrounding each case will determine the answer to the question.

In a few cases, especially in those localities where a prejudice has grown up against the double method of treatment, either due to poor results following its improper use, or to an improper understanding of the principles upon which this method of treatment are based, it will be impossible to make use of the double treatment, simply because the owner will not allow you to use it. While a reasonable amount of effort should be used to show the advantages of this method of treatment, yet it is not advisable to push your ideas in the matter to the point of arousing the ill-will of the man. It is better to make use of the single method than none at all, even if you are of the opinion that the use of the double method would have been the better practice. In introducing any new method of handling a disease which has for so many years been regarded as incurable it is only reasonable to expect a certain amount of "show me" attitude on the part of those who have been so often deceived, as has been the case in the matter of hog-cholera. It is necessary

to use a little common sense and diplomacy in dealing with these cases, and not try to force your ideas down the throat of another man without first giving him a chance to get an understanding of the matter. Get the confidence of the man, and you will not be long in winning him to your point of view.

When Serum Alone is Indicated.—While I am personally in favor of using the double method of treatment in all cases where it is possible, yet it is not the indicated method of treatment in all cases. There are instances where the single method should be used, and in these cases the results are usually the same as in the use of the double method.

As has already been explained, when the single or serum-alone method of treatment is used we simply place in the body the germ-fighting bodies which enable the animal to fight off an attack by the germs of cholera. If these germs are actually present, and really attack the animal, the result is the same as where the double method of treatment is used. These germs, while prevented from causing disease owing to the presence of the germ destroyers contained in the serum, do attack the cells, and they quickly learn the art of preparing the germ fighters. In this way the same results are accomplished as if the germs had been injected at the time the serum was given.

Another class of cases in which the single method of treatment can be successfully used is in those cases where unprotected hogs are to be placed in an infected feed lot. For instance, if a farmer has had an outbreak of cholera on his farm, and the feed lots have been entirely cleaned out of hogs, these feed lots still contain the germs of cholera, and if new animals, which have not been protected by vaccination, are placed in these same lots they will very quickly take the disease and die.

In case you are called upon to treat a herd of this kind that is about to be or has already been placed in an infected feed lot, it will usually be sufficient to simply give serum alone. The germs are already present in the feed lot, and will generally be taken up by the animal in sufficient numbers to produce the same type of reaction in the body as if they had been injected at the same time the serum was given, as is the case where the double treatment is given. The better method, however, is to give the double injec-

tion, as we are then certain the virus enters the body, and are sure of getting a permanent immunity.

From these examples we are able to draw a few rules for use of the single or serum-alone method of treatment:

(1) This method of treatment should be used in all herds where the disease is already present, as shown by the presence of sick animals, the death of one or more hogs, with the usual changes produced by hog-cholera to be found when the carcass is opened up, or by the presence of a number of animals in the herd showing a high temperature. In case of a herd that is located close to another herd in which cholera is present, if the animals show a temperature of above 105° F. it is pretty certain that they are already being attacked by the germs of cholera, and are well along in the incubation period of the disease.

These animals with a high temperature already have the germs of the disease present in their body, and it is not necessary to inject any more of them, so the single method of treatment is to be here given. Those that show normal temperatures in the same herd had better be given the simultaneous treatment.

(2) Animals that are about to be placed in pens that have recently been the seat of an outbreak of hog-cholera should either be given double treatment on the farm from which they are to be moved, or they can be given single treatment and placed immediately in the infected pens. The better method is to give the double treatment on the farm from which they are to be purchased, wait three weeks for the development of the complete effects of the treatment, and then bring them home and place in the infected feed lots. If the double treatment has been properly given, there will be absolutely no danger in placing these animals in the feed lots where the other animals have recently died, or even where there may be sick animals at the time.

(3) There is another class of cases where the serum alone might be given. This is in the case of very young pigs. The double treatment, while it has no bad effects on these little fellows, does not always give a permanent immunity, and it is considered advisable by some men to give the single treatment to these pigs, and follow it about six weeks later with the double method of treatment. This is especially advisable if there be an outbreak of

cholera in the vicinity at the time. Pigs are especially easy to develop cholera, and whenever an outbreak of the disease is in the neighborhood the pigs should be treated at once by either the single or double method.

If the pigs are farrowed by sows which have been given the double treatment, they will usually be found to have a power to resist the disease which will make it unnecessary to give any treatment until they are about ready to wean. Then the double treatment should be used.

When to Use Double Treatment.—With a review of the conditions under which the single method of treatment is used, it is not hard to form rules for the use of the double or serum-simultaneous method.

Remember that with the serum-simultaneous method we have the decided advantage that we are producing a protection which is not merely going to last for a few weeks, but are actually training the cells of the body in the way to manufacture these germ-fighting bodies which produce the disease, and we, in this manner, set up a serum plant in the body of the animal itself by means of which we have provided a continuous source of protection.

The cases in which this simultaneous or double method is indicated are those in which the infection of cholera has not already made its appearance; that is, in those herds where cholera is not yet present. For instance, if we go out into a herd and find that the disease is already present, several animals perhaps having already died, and a large number showing a high range of temperature, the double treatment would not be indicated. In this herd the virus of cholera is already present, and there is no need to further increase the amount of this virus by injecting virus-containing blood. In such hogs with high fever simply administer the serum alone in large dosage, even doubling the dose in those cases which show a temperature of 105° F. or higher. By this method we are able to protect the herd against the attack, and at the same time the action of the germs within the body will result in the development of the power of producing the germ-fighting bodies in sufficient number to result in leaving a permanent protection against an attack of the disease.

In those animals in this herd which do not show a temperature

of above 104° F., and which, accordingly, are not showing any signs that they have yet been attacked by the germs of cholera, there are two methods of treatment remaining open. One method is to give them serum alone, which will certainly protect them from the danger at this time, and if they become the object of attack by the cholera germs which are present in the feed lot they will also develop the power of producing the germ-fighting bodies which give a permanent protection against the disease.

Of course, there must always be some question in the cases that are handled in this manner as to whether they will take up enough of this hog-cholera virus from the feed lot to educate their cells to the need for producing germ-fighting bodies as a standing army to ensure freedon from further attacks. This is the all-important point in the development of immunity. A standing army of antibodies is just as important, as a guarantee against an attack by disease, as a standing army of trained soldiers is to the nation as a guarantee of peace with other nations which might be inclined to attack us were we not so protected. The resemblance is very close in the two instances. We have learned, as a result of our experience in wars with other countries, that it is absolutely necessary, if we are to be free from warfare, that we have a good supply of trained soldiers ready at a moment's notice to defend us from attack. A nation that has never been through a war cannot appreciate the need for such a body of trained fighters. It is just so with the body of the hog. It learns only by actual experience from an attack of the hog-cholera virus the need that it has for a trained army of fighters who will be able to prevent any second attack from the same source. As soon as it has met one attack of this kind, it never forgets the lesson learned, and in future keeps a well-trained guard always on hand.

In order to make certain that there will be such an attack, and the development of a permanent immunity in these animals which at the time of treatment are not affected with a high temperature or other evidences of cholera, it is a much better plan to give an injection not only of serum, but also of hog-cholera virus. In this manner we cannot possibly do any harm, and we make certain that the animal will develop a permanent immunity.

PROTECTION OF SURROUNDING HERDS

Having treated the herd which is the seat of the outbreak, the next step to be taken in the handling of the disease is to protect the herds immediately surrounding the one where the disease has made its start.

This can be done in part by the establishment of a quarantine of the infected farm, and by proper instruction of the owner of this infected herd as to burning of any animals that may die, and proper cleaning up of the feed lots after the outbreak has run its course or been checked by the use of the serum treatment.

Proper instruction should also be given by those in charge of the hog-cholera work as to the danger of passing from one feed lot to another. Hog owners should be instructed as to the danger from this source, and every aid that we can derive from proper quarantine and sanitary regulation should be made use of.

The next thing to be done is to proceed to the farms which immediately surround the infected farm, and protect the animals on these farms by the giving of the serum-simultaneous treatment. All the hogs within a distance of one mile in every direction, and especially those herds which are located on the farms which join fences with the infected farm, should receive this method of treatment.

In beginning the work in these animals it is always well to watch the temperatures carefully in the animals that are injected, and be on the lookout for cholera which has not yet made itself known by any visible symptoms. Watch for high temperatures, which are the first sign of danger. When an animal shows a temperature of over 105° F., and has been exposed to a possible chance of getting the infection, the safe course is to presume that the temperature is due to cholera which is starting to develop, and protect the animal by giving a double dose of the serum. In those animals which show a normal temperature, or even up to 104° or 105° F., give the regular dose of serum and at the same time a dose of the virus.

By doing this we develop a permanent immunity to hog-cholera in these herds, and we in this manner surround the infected herd by a wall of hogs which cannot possibly take the disease. This checks the spread of the outbreak, as the germs will not be able to

jump across a distance of over a mile unless dead animals are left exposed in the fields to attract crows, buzzards, and dogs. This is prevented by proper sanitary instruction of the owner of the infected herd, and a careful watch should be kept by state authorities to see that these sanitary instructions are carried out.

SIMULTANEOUS TREATMENT OF PIGS

At the commencement of an outbreak of cholera there are likely to be a large number of young pigs on the infected farm and also on the neighboring farms. What sort of treatment should be given to these pigs? Should they be given any treatment? These are questions often asked.

By all means these little fellows should be given the benefit of protection by serum. In case of a severe cholera outbreak all pigs should be treated, whether they be from an immune herd or not. These little fellows, born from immune sows, are protected from cholera just as long as they feed only on the mother's milk, but just as soon as they begin to eat other articles of food, such as slop, dirt, and anything which may be a carrier of the hog-cholera virus, they are liable to become infected and develop the disease. Cholera is very deadly in these small pigs, and once it gets a start with them it is almost sure to kill every one of them.

The question may come up as to how young a pig may be safely injected with hog-cholera serum. In answer to this question I would merely say that a pig is never too young to receive the serum treatment. Hog-cholera serum is absolutely harmless if it be made properly and is clean and free from germs of other diseases. The virus of hog-cholera is not present in the serum, and the germ fighters or antibodies present can produce absolutely no harm. If an outbreak of cholera is present or threatens on a farm, hog-cholera serum may with safety be given to pigs as young as two days old. Remember, however, that these little fellows require a larger dose in comparison with their size than do the older and heavier hogs.

In young sucking pigs it is not advisable to give the double method of treatment. The cells of these young animals do not seem to be yet in condition to take on the function of manufacturing germ-fighting bodies, and, as a result, the permanent

immunity which should result from the double form of treatment is not produced when the serum and virus are used in these little fellows. It is better in this case to give the single or serum-alone treatment, and six weeks or two months later on come back and give the double method of treatment. In this way they are protected from the immediate danger of the attack, and at the later treatment they are given a permanent protection which will enable them to remain free from the disease as long as they may live.

New Hogs Brought in From Other States.—In many sections of the country it is necessary to go away some distance and purchase new stock with which to fill up the feed lots. This may be because of a bad spring, with death of a large number of pigs from digestive and other disturbances, or may be due to the fact that an outbreak of cholera has wiped out all the hogs and left the feed lots empty. In bringing in hogs in this manner from outside of the state, or, for that matter, in bringing new hogs to the farm from any neighboring farm, it is always the proper plan to have these animals treated with the double method before moving them. Have the double method given right on the premises where the hogs are to be bought, and then move them to your premises at the end of three weeks.

In some cases this may not be possible, or may not be advisable for one reason or another. In such cases have the animals double treated just as soon as they arrive on your farm. It is then advisable to keep them in a separate pasture for two or three weeks, but with a first-class serum and a reliable virus they may be turned directly into the infected feed lots without danger.

Some would recommend that the animals in this case be given the serum alone, and allowed to contract the germ infection by being turned into the infected feed lot. While this method is in a measure satisfactory, it has some elements of uncertainty about it that makes the use of the other plan more advisable. In turning the serum-injected animals into this infected feed lot all is well, provided every one of them comes in contact with enough of the cholera germs to start up an attack in their body sufficiently severe to start the manufacture of germ-fighting bodies.

If for some reason, however, the germs of the disease did not enter the body of some of these animals until after the effects

of the serum had worn off, then they would be unprotected and would develop an attack of cholera. For this reason it would be a better method to make sure that each animal is going to get a sufficient amount of the cholera virus by simply injecting the virulent blood directly into the body at the same time that the serum is given. With a good serum there will be no danger of the animal developing cholera, even if placed in an infected pen where he will come in contact with more of the hog-cholera virus.

HANDLING OF COMPLICATIONS

After the giving of the double method of treatment it is always just within the bounds of possibility that some bad result may occur. The serum used may be of poor quality, and this is especially liable to happen if the serum used is put on the market without having first been properly tested by actual injection with virus into the body of young susceptible animals.

In such a case as this there might be an outbreak of cholera in the herd within a few days after the administration of the treatment. In such an event as this, what is to be done?

In point of actual fact there is great danger that but very little can be done. The time to have prevented this bad result was before the injection was made. The quality of the serum should have been made certain of before it was applied. Here, again, allow me to caution against the use of an uncertain serum, especially in giving the double method of treatment. In using the single method if you use a poor serum you may not have any bad results following, for the cholera germs may not enter the premises in sufficient number to set up the disease. When you use the double method you are dealing with a different proposition, and it is absolutely essential that you make certain that you are dealing with agents upon which you can absolutely depend. If you inject a real active virus which contains living hog-cholera germs, and inject with it an uncertain serum, you are very likely to have a large number of funerals to account for.

In case an outbreak of cholera should make its appearance in a herd that has received the double method of treatment, the only possible means of saving a part of the herd is to at once secure some real serum, and go back into that herd and inject with serum

alone, using double the usual dose for animals of the same size and weight. By this means you may be able to cut down the losses to a large extent, and save even 50 per cent. or more of the animals that would otherwise have died.

Treatment of Abscesses.—It is not by any means rare, even under the very best of care in giving the injection of serum, to have a few abscesses develop at the point where the serum was injected. The placing of a large amount of foreign material into the tissues tears them apart more or less, and sets up a reaction which is very favorable to the development of abscesses. Then, the hog is an animal that is kept under very poor sanitary conditions in most cases, and it is unusual if a considerable amount of dirt does not get into the wound left by the needle puncture. These are all conditions which favor the development of an abscess at this point.

When these abscesses do develop, it is proper that we handle them in a scientific and correct manner. Do not allow the abscess to run its own course, rupture, and scatter pus all over the feed lot. It is also a poor practice to slip up behind the animal while he is feeding, stick a knife into the abscess, and allow pus to drain all over the hog yards.

Dr. Balcher, of Newcastle, Indiana, reports a very interesting and instructive case of this kind, in which a sow suckling a litter of pigs developed an abscess in the ham after the injection of serum. The owner, at slopping time, slipped up behind the animal and, while she was eating, stuck a knife-blade into the swollen abscess, and made a large opening from which the pus drained very freely. The animal in walking about scattered the pus all over the feed lot. The pigs of this litter as well as those sucking other sows in the same feed lot were soon rooting around in this pus.

As a result, they carried these abscess-forming germs in their mouths to the teats of the mothers, and in a few days nearly every sow in the feed lot had a large number of abscesses of the mammary glands.

In case an abscess develops, have the animal caught and held as for administration of serum. Take a clean knife that has been sterilized by boiling, and make a good deep opening into the most

dependant part of the abscess. Allow the pus to escape on some clean cotton or clean rags or other material which can afterward be burned. After the pus has been squeezed out, take the finger and push it through the opening made with the knife and break up any pockets that the abscess may have and allow all the pus to escape. Now take some tincture of iodin, full strength, on a cotton swab, and thoroughly brush over the inside of the abscess. This done, the animal may be turned loose, and the abscess will quickly heal. The cotton or rags upon which the pus has been received should be destroyed by burning, and there will be no spreading of the germs of infection to other animals in the herd and the development of other abscesses.

Handling of Herd After Injection.—In a large measure the success that will follow the use of either the single or double method of treatment, and especially the double method of injection, will depend upon the after-care of the herd for the next week or ten days following the use of the serum.

Animals should, preferably, not be fed the night before or the morning of the day on which they are to be treated, and they should be fed very lightly for several days after the administration of the treatment. The body is at this time the seat of a terrific battle between the forces of disease, in the form of the cholera virus, and the forces of health, in the form of the germ fighters which are present in the serum which has been injected. The cells of the body are being trained to take part in this battle, much as the volunteers in time of war must be trained by the regular army officers. As a result, the tissues are in poor condition to use food, and the smaller the amount of food they receive during the few days immediately following the injection of the serum, the better it will be for the animal and the more successful will be the treatment.

Perhaps the best method of handling these animals is to place them on a short pasture and allow them to rustle for their food. In this manner they will get around a great deal. The moving about will have a tendency to work out the stiffness and soreness that develop as a result of the wound made by the needle, and, at the same time, the moving about increases the amount of absorption of the serum from the tissues where it was injected.

This is a very important point, as it is the amount of serum which is absorbed and carried to other parts of the body that does the good, and not the amount which is injected. We might inject a gallon of serum, and it would do no good if it is not taken up by the blood and the lymph and carried to other parts of the body.

The battleground between the germs of cholera and the germ destroyers of the serum is the blood, and it is absolutely necessary that we get as large an amount of the serum absorbed into the blood-stream as possible. The turning of the animals into a pasture where they will have to rustle quite a little in order to satisfy their appetites will very much increase the amount of the serum that will be absorbed, and will also make the time necessary for this absorbtion to take place very much shorter than it would be if the animals are allowed to lie around in a close feed lot and freely slopped.

Very little other food should be allowed during the first few days after the giving of the treatment. Plenty of water should be supplied, and this water should be clean and fresh, and should not simply be some mud-hole or old stagnant pond out of which the animal is forced to drink. A small amount of fresh slop may be given, but no sour swill should be allowed during this time. Dirty, sour, decomposed swill is bad enough as a food at any time, but especially is it liable to do harm at this time, in that it weakens the defenses of the body and increases the work which it is necessary for the serum to do in order to save the life of the animal.

I have frequently seen cases where hogs were given the serum alone or the serum-simultaneous treatment, and then turned into an old hog lot, in the middle of which was located a dirty mud-hole known as a hog wallow. The animals were allowed to wallow and burrow in this dirty, filthy mud, and then it was wondered at why a large amount of abscesses developed later on. No serum, no matter how clean it may be, can prevent the formation of abscesses when used under such conditions as these.

Keep the animals away from these hog wallows at least for a week following the use of the injection treatment, no matter which form you use. It is by carrying in of the pus-forming germs with dirt and mud that these abscesses are started in a large number of cases.

With a low-grade serum which has been made under dirty conditions it is not unusual to have abscesses develop as a result of the carrying in of pus germs with the serum itself. The proper way to avoid this form of abscesses is by refusing to use a serum that comes from plants that have not received the approval of the United States Bureau of Animal Industry with respect to the sanitary conditions under which they are operated.

Another fruitful source of abscess formation is the use of needles and syringes which have not been properly boiled before use. This is a very important point and one that should never be neglected.

GENERAL SUMMARY OF USE OF SERUM

From a consideration of the facts which have now been brought out concerning the use of serum, we are led to the following conclusions regarding its powers and the methods for its use:

(1) Hog-cholera serum is a substance which is made by taking the blood of an animal which has developed in its body the machinery necessary for the manufacture of enormous numbers of germ-fighting or germ-destroying substances, known as antibodies. This blood is simply treated so as to remove the parts which cause clotting, and is then ready for injection into the body of a healthy animal for the purpose of overcoming the effects of an attack by the cholera germs.

(2) This serum contains nothing that can in any way be harmful if properly made and kept clean, so as to be free from any germs or other disease.

(3) Serum, being a harmless substance, can be used in almost any dosage without producing any harmful effects. The main danger lies in not giving enough. There is no danger of giving an overdose of the remedy.

(4) In injecting serum there are a number of places in the body where it may be introduced. The most commonly used of these locations is to inject the serum with a long needle and syringe deep into the muscles on the inner side of the ham. The absorption of serum following this method of injection is believed to be a little better than from any other region of the body. The objections to this method are the loss which results to the packers from the development of abscesses in the hams when ham injection

is used, and the possibility of setting up an inflammation of the testicles in male hogs which might make them incapable of performing their duties as breeding animals.

Other favorite locations for the injection of serum are in the tissues behind the ear and inside the foreleg. Both of these locations are commonly used, especially in full-grown animals or animals that are about ready to go to market.

(5) Hog-cholera virus which is used with the serum in giving the double treatment is an entirely different substance from hog-cholera serum. It is the blood of an animal which is sick with cholera at the time that the blood is drawn, and it contains enormous numbers of the germs of hog-cholera in an active stage of development. These germs are ready and willing to attack any animal into which they may be injected or which they may reach by being scattered about in feed lots where hogs are located. Virus must, on this account, be handled with the most extreme care.

(6) In using the serum for management of hog-cholera there are two principal methods of use, viz., use of the serum alone, or use of the serum and virus at the same time in the same animal.

(7) When serum alone is used the animal is protected only just so long as the germ-destroying bodies injected with the serum remain in the body of the animal. Just as soon as this serum has been all worked off the animal is no longer protected.

The immunity or protection given by serum alone is, therefore, to be classed as a temporary immunity or temporary protection.

The length of time which this protection derived from the use of the serum-alone method lasts is only about six weeks in the majority of cases. There are a few cases in which animals given the single treatment have been found to be immune even as long as six months after use of the serum. This cannot be depended upon, however, and six weeks is about as long as can be relied upon for protection by this method.

The reason that the immunity derived from use of serum alone is only temporary is because there is nothing in the serum itself which has the power to teach the cells of the hog how to make germ-destroying bodies for themselves. In order for the cells to learn this art it is necessary that there be the actual entrance into the

body of the animal of the hog-cholera germs in sufficient numbers to set up a severe attack upon the body.

On this account, if serum alone is used where hog-cholera virus is already present in the body of the animal, as in those cases that show a high temperature, the protection which results proves to be of the permanent kind. By the time the effects of the serum have worn off the body is manufacturing germ protectors for itself, and there will always be an army of these defenders ready to stop any further attack of this disease which might occur later in the life of the animal.

(8) If *virus alone* were injected into the body of an animal it would *produce death* of the hog within five to fifteen days, depending upon the amount of virus which was used and the strength of this virus.

(9) When virus is injected into the animal, and a *dose of serum is also injected* at the same time, the *fatal outcome is prevented* by the presence of the large amount of germ destroyers that are contained in the serum. These germ fighters protect the cells of the animal body against the attack of the germs and the poisons which they form, and this gives the cells a chance to get busy and learn how to make these germ-destroying bodies. This is the underlying basis of the double method of treatment.

(10) Where the double method of treatment is used the cells of the body *are taught how* to make the germ-destroying bodies, and once they have learned how, they never neglect to keep a large supply of these germ fighters in the blood. The result is that the animal remains *protected for life.*

(11) There is absolutely no danger in using the double method of treatment if the serum used be of first-class quality. With a good serum there is no chance in the world for the germs to cause an outbreak of cholera, because their action is checked by the antibodies of the serum before they have had an opportunity to produce any harmful effect.

(12) The argument that the use of the double method of treatment results in the infection of the feed lots in which the animals so treated are kept does not appear to be proved. On the other hand, the outcome of experiments so far made along this line would seem to prove just the opposite to be the case. The virus that is

injected with the serum seems to spend its force within the body of the animal, and as the serum injected with the virus prevents the formation of new amounts of the virus, there does not seem to be any throwing off of active virus bodies in the discharges of the animal so treated.

(13) In using the double injection we are dealing with a method of treatment which in the hands of a competent man is just as safe as the single treatment, and it has the decided advantage that by its use there is created a permanent protection against hog-cholera, and the animal can stand repeated exposure to the disease with no bad results.

(14) Outbreaks of cholera following the use of the double method of treatment have never occurred where a tested serum was used by a competent man. Those outbreaks which have followed the use of this method of treatment have been due either to the use of a poor grade of serum or to lack of knowledge as to how the treatment should be given.

No man should be allowed to handle virus, or give the simultaneous method of treatment, unless he has a thorough knowledge of the agents with which he is dealing, and especially a complete understanding of the dangerous character of hog-cholera virus when improperly used.

It is an excellent plan, and one which is being followed by the majority of the state serum plants, not to allow the use of virus by anyone unless they have visited a serum plant and taken a thorough course of instruction as to the dangers of this agent and the methods of its use.

Dr. Peters, who until recently was the director of the Illinois State Serum Plant at Springfield, Illinois, says, in commenting on the need for careful supervision over the use of virus by those who do not understand its use, "I would not give serum to my own brother to administer by this simultaneous method unless he would come down and stay in the laboratory until he had learned how the work should be done."

As a result of the extreme care which surrounds the issuing of virus permits in the State of Illinois, Dr. Peters is able to report some most excellent results following the use of the simultaneous method in his state. He states that during the year 1912 fifteen

counties in the state were entirely freed from hog-cholera. That is to say, the disease was entirely eradicated in these counties by the use of the double method of treatment. Perhaps Dr. Peters is a little overenthusiastic on the results accomplished, but it certainly would appear that when the double method of treatment is limited in its application to men who thoroughly understand their business but very few bad results will be seen, and the good results obtained will be very satisfactory.

Further commenting on the use of the double method of treatment in Illinois, Dr. Peters says:

"When a man reports bad results from the use of the simultaneous method and comes back to the laboratory, I can practically always find that the results obtained were due to carelessness.

"Usually too much hurry, trying to catch a train; forgot the dose. A man has got to take his time and get his doses right, and see that he gets them injected right. If he don't, he is going to get in bad. Too much virus, not enough serum, and the trouble is on."

(15) In those cases where double method of treatment is given with a poor serum and a disease-producing virus there may be a severe outbreak of cholera follow. In these cases go right back and inject the animals again. Take the temperatures carefully at this time, and to every animal that shows a temperature above 104° F. give a double dose of serum, using a serum at this time that you know is of tested strength. In those animals which have a temperature below 104° F. again give the double method of treatment, using a strong virus and a tested serum.

As an example of what may occur in herds that receive simultaneous treatment improperly given, the following experience, quoted by Dr. Sihler, of Kansas City, is of interest:

"There was a herd of 465 shoats, weighing from 50 to 80 pounds. They were given what was presumed to be the simultaneous treatment. Just seven weeks after they received that treatment they began to die. I was called upon to make an investigation. I did, and I found that the herd was unquestionably suffering from an outbreak of cholera. I took the temperature of these hogs at that time, and I found that 82 per cent. of them had temperatures ranging from 105° F. on up to 108° F. or higher.

"The entire herd was re-treated. Those that had a high tem-

perature received the serum alone. In those that showed a normal temperature the serum and virus were injected. After the administration of the treatment only 6 animals of the herd were lost."

This experience was a most interesting one, and shows a couple of very valuable points:

In the first place, the treatment which was originally given as a simultaneous or serum-virus treatment was evidently not a simultaneous treatment at all. It is certain that the virus used in this case was no good. It was probably not virus blood at all, but simply blood from a healthy hog or, even more likely, was serum put up in virus bottles and sent out to be used as virus. This is a trick that has been practised by those who are making a poor grade of serum, and do not want to trust their serum for use against real virus. They simply send out the serum and with it bottles labeled "virus," which do not contain virus at all.

The development of a permanent immunity from the use of the double treatment depends as much upon the virus as it does upon the serum. Both must be of proved quality and strength. The virus must be capable of stimulating the cells to action in order that they may take up the work of manufacturing the germ-destroying bodies which are to protect the animal for the balance of its life.

If the substance used as virus is not a true virus at all, but simply serum or healthy blood, it will not start up a reaction in the tissue cells, and no germ-protecting bodies will be formed. As a result, as soon as the effects of the serum itself have worn off, the hog again becomes unprotected, and, as in the case of this herd, it will develop the disease.

In this herd the period of immunity lasted for about seven weeks. This is about the average immunity period for the single method of treatment. It is somewhat questionable if the serum originally used in this case was very strong in its protective power. If a good serum had been used the protection might have extended over a longer period of time.

In the second treatment, which was administered by Dr. Sihler, the rule was followed which has been laid down in this work: Inject serum alone in those animals which show that they are al-

ready affected; this being shown by the presence of a high temperature. In those animals which do not show any fever, and in which we are accordingly safe to conclude the disease has not yet made itself manifest, the double method should be used, injecting the serum and virus. By this means we insure the development of a permanent immunity in every animal in the herd.

This case also gives some idea as to what may be expected in those cases where serum is used after the outbreak has already made a start. In this herd 82 per cent., or over 375, of the animals had a high temperature. Some of these temperatures ran even as high as 108° F. or higher. Yet out of this large number of sick animals only 6 were lost after the injection of the serum had been made the second time.

This is a more brilliant result than can be hoped for in the majority of cases. Dr. Sihler was perhaps aided some in this case by the fact that these animals had several weeks before received a dose of serum, and even though this first serum may have been of poor quality, yet it probably had left some effects which would in part account for the brilliant results that followed this second treatment.

(16) The best rule to follow in giving the serum treatment is to give the single method wherever the disease is already present, as shown by the presence of temperature or other signs of cholera.

Some men prefer to give the single method in every animal of an infected herd, whether they show a temperature or not. This practice is based on the fact that the animals, by being in an infected feed lot and in close contact with animals which have the disease, will take enough of the virus with the air they breathe and the food they eat to produce the same results as would follow the giving of the virus by means of injection of virulent blood.

This cannot be absolutely depended upon, and in order to make sure that every animal in the herd will be left with a permanent immunity if they survive it is necessary that the entrance of virus into the body be made certain by its injection.

Remember, the immunity produced by the injection of the serum alone in those animals which are susceptible to cholera will be only temporary in character.

If these same animals are already infected by the hog-cholera virus, the effects from the injection of the serum alone will be the same as from the injection of the double dose in an animal which has never had the disease, the only danger being that, where the animal already has the disease, there is danger that the cells of the body have already been so weakened as to make it impossible to save the life of the animal even with the injection of serum.

As small pigs are not capable of developing a permanent immunity, it is well to give them the serum alone, and six weeks later inject them with the double method of treatment.

(17) The double method of treatment should be used in all animals that have been exposed to the disease and have not yet developed any symptoms of cholera, as shown by absence of a fever temperature and absence of any other signs of cholera, such as loss of appetite, weakness, staggering gait, or cough.

Where cholera occurs on one farm, the animals of the adjoining farms should receive the double method of treatment.

Animals that are about to be turned into a feed lot where hog-cholera has recently been present, or where there are at the time animals sick with cholera, should be injected by the double method of treatment. Some would advise rather that the serum alone be given, and the animal allowed to take up the germs in the usual way from the feed lot, but the double injection is much more certain and makes sure of a permanent immunity.

(18) By using hogs for breeding purposes that have been treated with the double method, and then giving the pigs a double treatment at the time they begin to take other articles of food as well as the mother's milk, it will be possible to keep every hog on the premises free from cholera, and the disease will die out for want of unprotected animals to attack. The hog-cholera virus cannot live long unless it has something to live upon in the shape of live hog bodies or the bodies of those that have been buried.

Serum and Swine Plague.—The question may be frequently met with, What effect will the use of hog-cholera serum have upon animals suffering with swine plague? Will the use of the serum have any effect as a curative in this disease? Will the use of the double method of treatment prevent animals developing swine plague?

These questions are best answered by referring the reader to the remarks already made, and those made in a following section upon the subject of Swine Plague.

Swine plague as an independent disease is a very doubtful entity. Personally, I am of the opinion that it rarely, if ever, exists as an independent disease. If it does, it is most certainly only in the form of a few cases scattered here and there, and it never takes on the appearance of a large outbreak, spreading over a wide area of territory and causing the death of a large number of animals.

Whenever there is an outbreak of some rapidly spreading disease among swine, which travels from one herd to another, causing a large amount of sickness and a large percentage of deaths, you can practically always set it down as a fact that you are dealing with genuine hog-cholera.

In some of these outbreaks the animals may show more signs of disease affecting the chest than the organs of the abdominal cavity, and when opened up after death the principal changes produced may be found in the lungs, yet you will find that this disease is hog-cholera, and simultaneous or single treatments with a serum of proved strength will check its course and spread.

The same may be said with reference to the so-called *infectious pneumonia* which was reported a few years ago from southwestern Iowa and Missouri. Dr. Shore, of the United States Bureau of Animal Industry Station at Ames, Iowa, made an investigation of the "new" disease that had been reported in this section of the country, and found that when the blood from these animals was injected into other healthy hogs it produced a typical form of cholera. It was also found that blood from the animals sick with the "infectious pneumonia," when injected into other hogs which were at the same time given the usual protective dose of serum, produced no bad effects. This would seem to prove conclusively that the "new" disease was, in reality, hog-cholera, with perhaps some slight changes in the usual course, and that the use of the serum was effective here the same as it is in other forms of the disease.

Need for Quarantine Measures.—If the use of the serum method of treating hog-cholera is to be made a success, we must have proper quarantine measures to accompany its use in order to aid in checking the spread of the disease more rapidly than it

would be possible to control even with the use of such an excellent agent as serum.

The best results from the use of hog-cholera serum will not be obtainable until we are able to get such sanitary laws enacted by state legislatures as will authorize the state veterinarian or other properly designated official to enforce strict quarantine in infected districts, such as that provided for in the regulations for Fayette County, Ohio, and Pettis County, Mo. The combination of proper quarantine, with free use of serum by both the simultaneous and the single methods, will soon show results. Cholera can and will be controlled, and the American farmer will be liberated from the greatest scourge to which he has ever been subjected.

Recognizing the importance of these sanitary measures in the regulation of cholera, the United States Sanitary Commission at its 1913 meeting adopted the following report of a committee appointed to draw up a report covering this phase of hog-cholera control:

"The committee recommends legislation authorizing or empowering the proper state authority to make and enforce the regulations suggested in the following outline, or such parts thereof as are necessary for the protection of local (state) interests and with due regard to the interests of the nation:

"*Providing for Quarantine and Shipping Regulations*

"1. The shipment or movement, interstate, of swine affected with cholera to be prohibited.

"2. Exposed swine to be shipped under permit and placarded.

"3. The movement of cholera-infected swine over the public highways of the state to be prohibited.

"4. Provision for moving exposed swine under permit in approved manner.

"5. Carcasses of animals, and particularly of swine that have died of cholera, to be burned within twenty-four hours after death, or, under special permit, be disposed of otherwise.

"6. The shipment by rail of swine for purposes other than immediate slaughter to be permitted only through special pens and unloading chutes or through portable chutes directly into wagons.

If unloaded in regular loading pens, to be moved under permit in approved manner.

"7. Public stock-yards to be under close supervision and cleaned and disinfected at intervals determined by the proper state authorities.

"8. Railway cars for the transportation of swine other than such as are intended for immediate slaughter to be cleaned, washed, and disinfected before swine are loaded.

"9. All cars in which diseased swine are found or in which exposed swine were shipped for immediate slaughter to be cleaned, washed, and disinfected within twenty-four hours after unloading, or cars to be held until presence or absence of disease has been determined.

"10. All cars or vehicles of transportation carrying cholera-exposed swine to be placarded in a conspicuous manner 'Cholera-exposed Swine for Immediate Slaughter.'

"11. Owners of swine and persons in charge, including attending veterinarians, to report without delay to state authorities all outbreaks of cholera among swine.

"12. Live stock sanitary authorities to quarantine all infected herds and premises, but may permit shipment of exposed swine for immediate slaughter as above provided. Infected farms to be placarded.

"13. Infected premises to be quarantined not less than sixty days after last traces of disease have disappeared and premises have been cleaned and disinfected.

"14. Infected premises to be cleaned and disinfected under supervision prescribed by live stock sanitary authorities.

"15. The live stock sanitary authorities to be given power to provide in a practical manner against the dangerous pollution of streams with hog-cholera virus, and provide for the safe disposal of garbage liable to be infected with hog-cholera virus.

"16. To prevent the spread of hog-cholera by swine shown for exhibition purposes, such swine to be treated with serum and virus not less than forty days prior to the opening date of the exhibit, or with serum alone not more than fifteen days before such time.

"17. Provision for controlling for thirty days by quarantine or otherwise, when deemed advisable by the proper authority, of all

swine treated with serum-virus, or premises on which such swine are kept, to prevent danger of possible spread of infection from inoculated animals.

"18. Penalty for failure to comply with regulations made under authority of this act by the live stock sanitary authorities of the state to be made punishable by fine: ten dollars for first offense, one hundred dollars or imprisonment, or both, for second offense.

"*Distribution and Administration*

"Virus in connection with serum or virus alone to be shipped, sold, or supplied to and administered by specially licensed persons only and under direction and supervision of state authorities as far as practicable.

"*Regulation of the Sale of Proprietary Remedies for Hog-cholera*

"1. Providing for the disclosure of the nature of advertised proprietary remedies and investigation of their merits by the live stock sanitary authorities of a state and publication of results of such investigation.

"2. Providing for the enforcement of the laws suggested in the foregoing, and regulations made under authority of the same by the proper authorities charged with the control of animal diseases.

"3. Providing adequate penalty for violation of the provisions of such laws or of regulations made under authority of the same.

"4. Specifying methods to be followed in prosecutions of violations.

"5. Appropriation of necessary funds to administer the law."

Who Should Administer Serum?—This is a question that frequently arises. Should the administration of serum be limited only to those who are licensed to practice veterinary medicine? Many practitioners would assert that this should be the rule. I hardly agree, however, with this statement. The demand for use of serum will soon be so large that it would be impossible for the present members of the profession to meet the demands upon their time which the work would require. Furthermore, this work is more or less unprofitable as compared with other lines of practice,

and by no means all the members of the profession care to engage in it at all.

On the other hand, I do not believe that those who have not had proper instruction in the correct methods of administering the treatment should be allowed to handle either serum or virus, and, by all means, that they should not be allowed to handle the virus. It would seem to me a wise precaution to insist that a man who is to receive for injection purposes hog-cholera virus should at least have some scientific training. Many of the state serum plants have in a way met this need by establishing what are classed as instruction days, on which farmers and others are received and given a brief course of instruction in the handling of serum and virus.

I do not believe, however, that any man without previous scientific education can acquire a sufficient knowledge of serum and virus and the dangers of the virus in a one-day visit to a serum plant. It is this use of virus by the man who does not fully appreciate the danger of carelessness with it that has brought bad results. Special training of at least one or two weeks would seem little enough to entitle a man to secure a virus permit, which would entitle him to receive and handle the materials necessary for injection of the simultaneous or double treatment.

Larger appropriations by both Federal and State Agricultural Departments and provision for the organization of a thorough campaign of eradication of the disease would be a mighty step in the proper direction. This campaign could be put in charge of competent veterinarians, and they could be assisted by a corps of well-trained laymen. This would somewhat reduce the cost of the work, and with competent direction from well-trained experts these laymen would be able to satisfactorily carry out a large part of the work. If success is to be achieved the treatment must be handled by men that are qualified to use it properly.

CLINICAL EVIDENCE OF VALUE OF SERUM

It has already been stated in this work that the great share of the credit for the discovery and development of the serum method of treatment for hog-cholera is due to Drs. Niles and Dorset of the United States Bureau of Animal Industry. As an example of the large amount of painstaking work which these men carried out, as

well as for the excellent proof of the efficiency of hog-cholera serum which they offer, the following report of their early experiments is of value.

These 47 case reports were first publicly announced by Dr. Niles in the 1908 Annual Report of the United States Bureau of Animal Industry. This chapter of the 1908 report is one of the most interesting articles which ever appeared in the literature of hog-cholera. The nature of the experiments made and the results obtained set the entire hog-producing world agog with interest, and the real work in development of practical use for serum may be said to date from this time.

It has been my purpose in presenting these cases to follow very closely the original report of Dr. Niles, as presented in the article above referred to. In addition, I have added an analysis of each report, which I trust will prove of assistance to the reader in obtaining the highest amount of practical knowledge from them. These case histories are the actual experience of men who have devoted a lifetime to the study of hog-cholera and means for its eradication. They are the foundation for our present scientific treatment of the disease. Each case has many instructive lessons for the owner of swine as well as for the veterinarian engaged to treat them.

In this series of experimental tests of serum the practice was very much the same as that being used to-day. Our present methods are based on the results of these experiments, as well as many others that have since been made by government, state, and private investigators. Some improvements have since been made. For instance, in these histories no report is made of taking of temperatures in the treated herds. This is a very important essential in proper handling of the disease, and one which should be universally followed. The thermometer reading is of the utmost importance in making a diagnosis of the disease in those cases where visible symptoms have not as yet been developed. The high temperature gives warning of the presence of cholera at least twenty-four hours before loss of appetite, diarrhea, cough, or other clinical evidence shows its diagnostic signs.

The rule of practice in treating sick and exposed hogs has been somewhat revised since the date of these investigations. It has been found, for instance, that large doses of serum alone injected

in sick animals will save a large percentage of them. It has also been found that contact infection cannot always be depended upon, and, accordingly, the better plan is to give the double treatment in every hog that does not show by presence of fever or other signs that it is already sick. This applies with equal force to infected or exposed herds.

I wish again to acknowledge my indebtedness to the official report of Dr. Niles for the basis of this experimental evidence of serum injections. I give these in preference to results reported by other men or myself on account of the great importance of this series of investigations in establishing the serum treatment of cholera on a firm basis.

Herd Number One.—This first herd which was used in the carrying out of the investigation experiments of Drs. Niles and Dorset was located on the northwest quarter of Section 9, Nevada Township, Story County, Iowa. This farmer had had a herd of 100 head of hogs at the beginning of the season. Cholera of a most virulent type made its appearance in the herd, and at the time the farm was visited by the United States veterinary experts 90 out of the total of 100 head had been lost. The postmortem evidences revealed by examination of the carcasses of several animals recently dead of the disease were typically those of cholera. Sick shoats remaining among the 10 living also showed the usual symptoms of cholera.

It was evidently too late here to do any great amount of good for the owner of this herd, but arrangements were made with him to carry out an experiment on his farm, to demonstrate the efficiency of serum as a preventive agent against hog-cholera infection. For the purpose of carrying out this experiment 13 small shoats, averaging in weight from 35 to 40 pounds, were purchased. These animals were bought from a herd which was perfectly healthy, and the animals had not, so far as known, been in any way exposed to hog-cholera.

Ten of these animals were injected with hog-cholera serum, each shoat receiving 20 c.c. of the serum. The other 3 were left untreated, to serve as checks. The entire 13 hogs were then placed in the infected pens, together with the sick animals which remained from the original herd. In this manner they were ex-

posed to infection not only from the virus which remained in the infected feed lots, but also by direct contact with the sick herd and with their virulent bowel and urinary discharges.

The date on which these animals were injected and placed in the infected pens was September 9th. Ten days later the 10 that had been injected with serum were still in good condition, but the 3 check pigs which were not protected by serum were already beginning to manifest symptoms of the disease. The herd was again visited on September 25th, and at this time one of the check animals was dead. The other 2 checks were in a very sick condition, and exhibited all the usual symptoms of hog-cholera. Five days later, September 30th, all 3 of the check pigs were dead. Thus, within a period of twenty-one days the 3 healthy shoats which had not been previously exposed to the disease had contracted cholera and all had died. Of the serum-injected animals all remained well throughout the experiment except one, which developed a slight soreness of the eyes. This was perhaps entirely accidental and had nothing whatever to do with the use of serum. Not only did these shoats remain healthy throughout the course of this experiment, but they did not afterward contract the disease in so far as is known, later observations showing that all 10 remained well and thrifty.

This experiment brings out some very interesting facts about cholera which are worthy of noting.

It proves conclusively that the disease will attack healthy animals which have not been previously exposed if they be placed in an infected pen or brought in contact with others that are suffering from the disease.

This experiment serves also to show the short incubation period of the virulent types of hog-cholera, and especially so in young shoats. All 3 of the untreated animals were showing symptoms of the disease at the end of ten days, and so rapid was the course of the outbreak that the entire herd of untreated hogs was wiped out in less than three weeks from the time of exposure.

In connection with those treated, it is indeed a most interesting observation that while all 3 of the untreated animals quickly sickened and died, not one of the 10 that were treated even became seriously ill. The sore eyes which were developed by one of them were no doubt entirely due to some other cause

than cholera. The hog-cholera serum used in this case unquestionably proved protective, in that not one of these animals proved in the least susceptible to the disease. This in spite of the fact that they came from the same herd and were placed under exactly the same conditions.

The dose of serum used is also worthy of note. In this experiment the amount of serum injected was approximately ½ of 1 c.c. per pound weight of the hog. This is about the average dose which is being used by the United States Bureau of Animal Industry in the present campaign of eradication against hog-cholera.

Herd Number Two.—This herd was located just across the road from Herd Number One, and consisted of an old sow and her litter of 5 shoats, averaging in weight about 75 pounds each. These animals, although in close contact with the infected premises, had so far remained well. The owner of the herd was present when the hogs on Farm Number One were treated, and, believing that his own herd was in great danger owing to the close proximity of the infection, he requested that they receive treatment.

As the infection had not yet made its appearance on this farm, the animals received the serum-simultaneous treatment. Three of the pigs were injected, each receiving 20 c.c. of hog-cholera serum and 2 c.c. of virulent blood. The other 2 were left untreated, to serve as checks on the experiment. In this case the disease did not make its appearance at all, neither in the injected nor in the untreated animals, so that in a measure the outcome was uninstructive, as the serum did not have a chance to demonstrate its power in the presence of infection.

However, there are several interesting facts worthy of note in connection with this herd.

In the first place, it shows that hog-cholera is not often an air-borne infection. This herd, which was located just across the road from the infected yards on the first-mentioned farm, did not contract the disease. This was no doubt in great measure due to the fact that no direct communication was carried on between the two feed lots. Cholera will not often travel across as wide a space as a public road unless it is carried by man or animal. Under proper sanitary conditions there is no reason why cholera

should be spread from one farm to another even where they are in as close contact as were these two herds.

This test serves to give an example of how the simultaneous method of treatment is applied: 20 c.c. of serum and 2 c.c. of virulent blood were injected into each one of the test animals. As none of these animals afterward became sick it serves to show that the serum was protective even against relatively large doses of the pure culture virulent blood. The dose of serum given in this case was relatively a little smaller than that usually given.

In connection with certain arguments which have been made against the simultaneous method of treatment in some parts of the country, this experiment is also a source of intelligent observation and conclusion. Some men have made the argument against the simultaneous methods of injection that by so doing there was danger of infection of the premises by the discharges of the animals so injected. This it was pointed out would result in the establishment of an infectious feed yard, which would be the source of infection to any healthy hogs which might afterward be brought upon the place.

Here we have in this experiment 3 animals injected by the simultaneous method and left in constant association with the healthy shoats, who were not so protected by either serum-alone or serum-simultaneous injection. Yet neither of the check pigs developed any symptoms of cholera. Evidently if there was infection of this feed lot from the discharges of the simultaneously treated swine the disease would have made its appearance in these untreated animals.

It is also interesting to note that the simultaneously treated hogs in this experiment did not show any bad effects from the treatment, but continued to thrive and do well just as if nothing had happened to them at all. When properly given there is absolutely no danger from the simultaneous method of treatment and its advantages are manifold.

Here also we get an idea as to the class of cases in which serum alone is indicated, and the class of cases in which the serum-simultaneous method is to be used. In the treatment of the animals intended to be placed in the infected pens on Farm Number One serum alone was used. You may ask why? Simply because in

this case the animals were to be placed in direct contact with infected animals and on infected premises. Accordingly, it was considered unnecessary to inject any of the hog-cholera virus. This was quickly obtained by the animal through natural channels when placed in an infected feed lot and in contact with infected animals. Yet the immunity produced in this first herd was evidently of a permanent nature, as we find that later observations of this herd showed that the animals remained thrifty and well. Under ordinary circumstances the immunity produced by the serum-alone treatment lasts but about six weeks, or sixty days at the outside. When, however, as in this case, serum is given to animals which are in infected pens or in contact with infected animals, the results are often practically the same as when the virus and serum are both given by injection. That is, we have the development of a permanent immunity. More recent tests have proved, however, that this cannot always be relied on, and it is better policy to give the double treatment to healthy animals intended to be placed in infected lots.

In treating herds similar to Herd Number Two, above mentioned, where there has been no appearance of the disease, but where the animals are in close association with an infected herd, the proper procedure is to administer the serum and virus together, thus producing a permanent immunity. Otherwise, if only serum alone is used, the protection afforded is only a temporary one, and after the lapse of sixty days the animals are again susceptible to the disease.

Herd Number Three.—This herd was located on a farm one mile east of Herd Number One, and the infection in this case probably had its origin on the first-mentioned farm. When the first visit was made on September 14, 1907, 2 old sows had already died from the disease. One of these was cut open and a postmortem examination made, which showed typical lesions of hog-cholera. Several of the late summer pigs were also showing symptoms of the same disease. There were also a number of spring pigs in the herd, and some of these were beginning to show slight symptoms of being unwell. In some of the sick animals the symptoms of hog-cholera were well developed, including a marked diarrhea. Later in the course of the experiment the un-

lent blood. The date of administering the treatment in this herd was September 25th.

On the following day one of the treated shoats appeared somewhat off feed and droopy. Two days later one of the old sows became sick, showing loss of appetite and other symptoms. The condition of this sow gradually became worse and she died nine days after treatment. Postmortem examination was made and the usual lesions of hog-cholera were found—engorged spleen, congested liver, hemorrhages in kidneys, and well-marked ulceration of the cecum and colon. The shoat which showed symptoms of illness also became worse and finally died.

The shoat which had escaped, and was consequently left untreated, also became sick and died. In the case of the sucking pigs left untreated, the disease rapidly wiped out all of them, the entire litters dying in each case. The remaining 28 treated shoats and the 2 old sows remained well and thrifty, showing no signs of illness.

At first glance there might be a tendency to think that the death of the old sow and the shoat had been due to the use of the virus treatment. If we stop a moment to consider what we have learned about the incubation of hog-cholera, we will readily see that this could not have been the case. The incubation period, even in animals which have been injected with the virus and have received no simultaneous protective dose of serum, is seldom less than five days, and rarely, if ever, less than three days.

In this case the shoat showed signs of illness within twenty-four hours after injection, and the sow was sick within three days. The conclusion which we must of necessity arrive at in this case then is, that the disease must have already been carried to the premises and was in the incubation stage at the time the treatment was administered.

When we stop to consider the effects of the treatment in this herd, we cannot be other than impressed with the efficiency of the serum treatment again, both as a prophylactic and as a curative agent. The subsequent sickening and death of the one shoat and the old sow shows that the disease was already present on the premises, and many of the other injected animals were undoubtedly developing cholera at the time the treatment was given.

untreated animals, leaves no question as to the deadly nature of the disease.

We must, therefore, conclude that in this instance the serum proved of value not only as a prophylactic agent, but also, to some extent, as a curative.

While the advocates of the serum method of treatment have never been strong in their arguments in favor of the use of serum as a curative measure in cholera, and have contented themselves with urging the use of the agent as a simple preventive, evidence is constantly accumulating to show that serum, when properly made, does possess quite appreciable curative properties, and the results being obtained in various parts of the country justify its use even in sick animals, unless the hogs are already in a dying condition.

During the time that I was engaged in the demonstration work in Missouri we injected a number of swine which gave every evidence of being infected at the time, and several of which manifested high temperatures at the time of injection. Our results in many of these cases exceeded expectations, and led me to the conclusion that further experimentation with this agent will establish for it a place in the rank of curative agents as well as simple preventives.

Herd Number Four.—This herd was located in the northwest quarter of Section 11, Grant Township, Story County. When the farm was first visited on September 25, 1907, the herd was apparently well, although the disease had for some days been only half a mile distant. The herd at this time consisted of 30 spring shoats, each weighing from 75 to 100 pounds, and 3 old sows with young litters.

In planning the experiment the intention was to treat all of the animals except the sucking pigs. In corraling the herd for treatment, one of them escaped and could not be afterward located. This animal, therefore, went untreated. Consequently, 29 shoats and 3 old sows were treated, the shoat which escaped and the sucking pigs being left as checks. The method of treatment here used was the double or serum-simultaneous method. Each shoat received 20 c.c. of serum and 2 c.c. of virulent blood. The old sows were each given 40 c.c. of serum and 2 c.c. of viru-

lent blood. The date of administering the treatment in this herd was September 25th.

On the following day one of the treated shoats appeared somewhat off feed and droopy. Two days later one of the old sows became sick, showing loss of appetite and other symptoms. The condition of this sow gradually became worse and she died nine days after treatment. Postmortem examination was made and the usual lesions of hog-cholera were found—engorged spleen, congested liver, hemorrhages in kidneys, and well-marked ulceration of the cecum and colon. The shoat which showed symptoms of illness also became worse and finally died.

The shoat which had escaped, and was consequently left untreated, also became sick and died. In the case of the sucking pigs left untreated, the disease rapidly wiped out all of them, the entire litters dying in each case. The remaining 28 treated shoats and the 2 old sows remained well and thrifty, showing no signs of illness.

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When we stop to consider the effects of the treatment in this herd, we cannot be other than impressed with the efficiency of the serum treatment again, both as a prophylactic and as a curative agent. The subsequent sickening and death of the one shoat and the old sow shows that the disease was already present on the premises, and many of the other injected animals were undoubtedly developing cholera at the time the treatment was given.

The results of the disease in the untreated shoat and the sucking pigs leaves no question as to the virulency of the outbreak in this particular case. The disease here, as in the other herds which have been described, was of the usual severe and extremely fatal type. But for the injection of the serum on this farm the total death loss would have undoubtedly been almost the entire herd.

In this instance we again get a suggestion as to the proper method of administering treatment. In this herd there were no visible evidences of cholera at the time of treatment, and on this account the double or serum-simultaneous method of treatment was used. In this way not only were the swine protected against the epidemic then present in the neighborhood, but there was also the establishment of a permanent immunity which will last throughout the lifetime of the animals. Had temperatures been taken many of those apparently well would have been found sick, and in those cases serum alone in large dosage should have been given.

It is by the use of this method of treatment that we may hope eventually to control and even eradicate hog-cholera. If we establish a permanent immunity in this herd, these animals will not be susceptible to infection next year, and it has also been quite definitely found that pigs born from immune sows have a more or less strong immunity which persists as long as they are still sucking. In these cases the protection is probably in a measure due to immune bodies which are transferred from the mother through the milk. If these pigs are then simultaneously treated about the time of weaning we will establish in them a permanent immunity, and in this way we will gradually build up in each district herds of immune hogs. In this manner we remove the possibility of cholera developing on this farm, and make just one less possible source for outbreak the following year. Through this method of procedure we will finally succeed in establishing such conditions throughout the country that outbreaks of cholera will be few and widely scattered, and easily stamped out before they have gained any such headway as is now seen every year in the Corn-belt States.

Herd Number Five.—This herd was located in the southeast quarter of Section 35, Grant Township. It was first seen

on October 4, 1907. At the time of making the first visit one of the shoats had already died, but there was no evidence of sickness in the other animals of the drove. An autopsy was made on the dead shoat, which revealed the characteristic lesions of hog-cholera—hemorrhages in the lungs, dark-red spots in the kidneys, engorged and swollen spleen, enlarged lymphatic glands, and ulceration of the large bowel.

In outlining the method for carrying out the experiment in this herd, 39 spring shoats, weighing from 40 to 60 pounds each, were chosen for injection purposes. Eight shoats of about the same average size were left untreated as checks. Five old sows were also treated, but their litters, numbering in all 30 sucking pigs, were left untreated. Each of the injected shoats received 20 c.c. of serum. Each of the 5 old sows injected received 40 c.c. of serum. No virus was used in this experiment.

The results of this experiment were as follows: Four of the 8 check shoats became sick and died. Two others showed symptoms of the disease, but finally recovered, although they remained in an unthrifty condition and were rendered practically valueless. Two of the treated pigs died, while the remaining 37 remained well and thrifty. The old sows remained well, while all but 4 of the sucking pigs died.

When we stop to analyze this report, we find that there are several points of interest to be derived from it:

(1) In this herd cholera was already present, as is seen from the fact that 1 shoat had already died, and the 2 treated shoats which afterward sickened and died were perhaps already well along in the state of incubation at the time that treatment was given. Many of the other animals also were no doubt developing cholera at the time of treatment, and but for the use of the serum the death-rate would unquestionably have been very high.

(2) The 2 animals which were left as checks and did not sicken are an example of the natural immunity to the disease that sometimes is met with. However, we here see how relatively rare this natural immunity is, as only 2 animals of the 47 showed this natural protection.

(3) In this herd we again see an example of the extreme viru-

lency of cholera in small pigs, all but 4 of them being carried off by the disease.

(4) It is also interesting to note in this case that the 2 animals which made an apparent recovery from the disease remained unthrifty and practically valueless. This is usually the case. Animals which show severe symptoms of cholera and recover are usually left in an unthrifty condition and are rarely profitable to keep. In the majority of cases it is more economic to destroy the runts than to bother with keeping them.

(5) In this herd the serum alone was used, as there was evidence that the animals already were infected. In this case it was thought unnecessary to inject any virus, as the hogs already had been inoculated with virulent material which had been absorbed by contact with infected animals. In this case the immunity conferred was of the permanent type in most of these animals, just the same as if they had received the simultaneous or double treatment. This is the rule which should be followed: Give serum alone where the animal is already infected as shown by actual symptoms of the disease or presence of temperature above 104° or 105° F. On the other hand, in treating exposed herds, where there is no evidence of the actual presence of the disease, give the simultaneous or double treatment. The double treatment should also be given in infected herds to those that show no evidence of cholera and have a normal temperature.

Herd number six in this series of experimental inoculations was located in the northeast quarter of Section 3, Grant Township, and probably became infected from a diseased herd which was being fed just across the road. This farm was first visited on October 5, 1907. At this time there was one shoat sick, which had been noticed unwell for three days. The animal was not markedly sick, but was noticeably droopy and was not eating well. Another hog was also seen to be slightly off feed, but the remainder of the herd showed no visible symptoms of disease. All of the animals, however, sick and well, were running together in the same feed lot and pasture, so that the healthy ones had all undoubtedly been exposed to the infection, and many of them were in various stages of the period of incubation.

In this experiment 12 shoats, ranging in weight from 40 to

70 pounds, and including 2 sick animals, were left untreated as checks. The remainder of the herd, consisting of 67 in all, were treated, being given the serum-simultaneous injection. Each animal received 20 c.c. of serum and 2 c.c. of virulent blood.

The results of this experiment are quite interesting, in the fact that they give us considerable information showing that injection of virus with proper dose of serum is not injurious even in the presence of visible infection.

Of the 12 shoats which were left untreated, 10 became sick, exhibiting the usual symptoms of hog-cholera. Of these 10, all but 2 died. The 2 that recovered never made a full recovery, and always remained more or less stunted and unthrifty. Of the 67 animals that were treated, only 3 sickened and died. The remaining 64 animals remained well and thrifty.

The heavy loss among the shoats left untreated as checks goes to show that the disease was of a most virulent type, and but for the prompt use of the serum almost the entire herd would have been wiped out.

One of the interesting points to note here is the fact that no harm was done even by injection of virus in the presence of contact infection. The serum-simultaneous method of treatment is practically entirely harmless if used by those who understand their business and use it with due regard for its potency and possibilities for harm. The 3 animals that died were undoubtedly already severely infected at the time the treatment was given, and had already passed well along in the incubation period. However, the injection of the virus used undoubtedly had nothing whatever to do with producing the death of these 3 animals.

Again in this instance we see an example of the stunted condition which usually remains in animals which naturally contract the disease and recover.

We also have in this herd an example of 2 animals which apparently possessed a natural immunity, as 2 of the untreated checks did not develop any symptoms of cholera.

Herd number seven of this experiment was located in the northwest quarter of Section 27, Grant Township, Story County, Iowa. This herd was first seen on October 7, 1907. At the time of this first visit these hogs were already in a very seri-

ous condition. There were a number of the shoats in which unmistakable symptoms of hog-cholera had already developed. They were droopy, did not care for food, and a few of them had already started a characteristic diarrhea. Evidences of something wrong with the herd had been noticed for three or four days previous to the visit of the United States officials. Only a few hours before the arrival of the bureau veterinarians 2 of the animals had died.

Postmortem examination of the hogs which had recently died was made, and typical lesions of hog-cholera were found, including enlarged lymph-glands, engorged spleen, turkey-egg spots in the kidneys, ulcerations in the bowel and around the ileocecal valve, and enlargement and congestion of the liver.

This herd was composed of two lots. The shoats ran in one pen and the sows were kept in a separate feed lot. The disease had first made its appearance among the shoats, and all of them had already been thoroughly exposed to the disease, as the sick animals had been in these pens for the past four days, and 2 had already died in this lot. The disease had not yet made its appearance among the old sows, but their close proximity to the infected shoats made it very probable that the infection would soon be carried to them.

Twenty-nine shoats were selected for injection. All of these had been thoroughly exposed to the disease, and many of them were undoubtedly well along in the period of incubation at the time of treatment. Each of these animals received an injection of 20 c.c. of serum. Fourteen animals were left untreated. Of these, 4 showed no apparent symptoms of disease whatever; the other 10 were more or less visibly affected.

In handling the 14 old sows, 11 of them were given an injection of 30 c.c. of serum, and the remaining 3 received 30 c.c. of serum plus 1 c.c. of virulent blood. Later—on October 23d—these sows were turned into the same feed lot with the sick shoats.

The results of this experiment are quite interesting. Here we have the use of the serum in a herd of shoats which were already in a badly diseased condition, and in which its use would appear to be almost hopeless. These hogs had been so thoroughly ex-

posed to the germs of cholera that they were all sick at the time of injection, and a hog sick from cholera is usually regarded as a dead hog. If temperatures had been taken for this experiment they would very likely have shown that every one of the treated shoats was sick, and, on account of their close association, the old hogs would also, no doubt, have been found to be coming down with cholera.

Final returns, however, show that of the treated pigs, 12 survived and 17 died. Of the 14 checks, 11 died and 3 lived, one of which was so stunted in growth as to be worthless. All of the old sows survived, and not one of them showed the slightest evidence of being sick, even after being turned into the disease-infected feed lot.

This report should prove quite instructive. The use of as small a dose of serum as 20 c.c. in these sick pigs saved over 40 per cent. of them. If temperatures had been taken, and larger doses of serum given, it is quite probable that even a much larger number would have survived. The figures, even as they stand, when compared with the results in the untreated checks, leave a very favorable showing for the use of serum even in the presence of the disease.

Results in the case of the treated sows are most interesting. These old hogs had almost certainly been exposed to a certain degree at the time of injection. Cholera had not got much headway in their bodies at that time, and the use of the serum promptly checked the inroads of the germs and saved them from any loss. In these sows both the serum-alone and the serum-simultaneous methods were used. In both cases the results were excellent. In many of these old hogs cholera germs were already present, and in such cases the injection of the single treatment stimulated production of germ-fighting bodies by the cells of the body and a permanent protection was developed.

The most interesting part of this experiment is contained in the last part of the report, wherein it is shown that the sows, when turned into the diseased lots, did not become sick. At the time the sows were placed in the infected lot two weeks had elapsed since they were given treatment. The protection given by the single as well as that derived from the double injection was active at this

time, and the results give proof that in both cases the defense given was of sufficient power to prevent any harmful effects.

Herd Number Eight.—This herd was located in the southeast quarter of Section 1, Grant Township. The owner of these hogs had already had an outbreak of cholera on his premises, and had lost nearly all of his herd. He was anxious, however, to test the effects of the serum in protecting new hogs that were to be placed in the disease-infected feed lots.

In order to carry out this experiment, 12 shoats were purchased, each weighing about 100 pounds. These animals were bought from a farm where cholera had not been present, and they had no opportunity of having been exposed. He also purchased 4 smaller pigs from another farm on which there had been no cholera.

Of the first lot of 12 shoats, 11 were injected with 20 c.c. each of serum and with 2 c.c. of the virus blood. The twelfth pig of this lot and the 4 smaller pigs were left untreated, and the entire lot, treated and untreated, were placed in the diseased feed lots. In this feed lot there still remained a few animals suffering from the chronic type of cholera.

For some reason the infection appears to have died out very rapidly on this farm, as neither the injected nor the untreated animals took the disease. Either the disease germs that had been present were already killed out, or these pigs had by some means developed a resistance beyond the natural against cholera.

While the experiment was not satisfactory as a demonstration of the protective power of the double treatment against cholera, it does show a few interesting points:

In the first place, it shows that with a first-class hog-cholera serum shoats weighing as much as 100 pounds can be safely protected by as small a dose of serum as 20 c.c., and this even when given double the usual dose of virus blood used in regular field work.

This experiment also offers further proof of the fact that there is but little if any danger of infecting the premises from placing in the feed lots animals that have received the double treatment. Here we have 5 unprotected hogs placed in the same feed lot with 11 shoats that had been given the double treatment, and none of

them became ill as a result of close association with the treated animals.

This experiment also offers proof of the desirability of using the double method of treatment when placing hogs in an infected feed lot, rather than depending upon the entrance of the virus of the disease through the regular channels of infection. If in this case the serum alone had been used, and dependence placed upon the animals taking up the necessary germs from the feed lot to result in the training of the cells in the method of manufacturing germ-fighting bodies in order to establish a permanent protection, the results would have been disappointing. The only certain method of getting a permanent protection against the disease is by injecting both the virus blood and the serum, unless the animal already is infected with the germs, as shown by a high fever or other signs of commencement of the disease.

Herd Number Nine.—The herd which formed the basis for this ninth experimental test with serum was located in the northeast quarter of Section 2, Union Township, Story County. This herd was located about 20 rods from the herd which has been described as Herd Number Five in this list of experiments. At the time the herd was first seen, October 10, 1907, the hogs were already infected. The disease had most likely spread to this herd from Herd Number Five, just mentioned, or from other disease-infected farms, of which there were quite a number in the immediate neighborhood.

When first observed by the United States veterinarians there had been no deaths in the herd, but 2 of the shoats had been sick for a couple of days with symptoms which were unquestionably those of cholera. The balance of the hogs were still apparently healthy.

There were in this herd at the time 35 shoats and 2 old sows. Thirty of these shoats, including the 2 that were sick with the disease, were injected, each receiving 20 c.c. of serum and 1 c.c. of virus blood. The dose of the virus blood given in these animals was cut down to 1 c.c., on account of the fact that cholera infection was already present. The temperatures met with in these hogs are not reported. The 2 old sows were also injected, each receiving 40 c.c. of serum with 1 c.c. of virus blood.

The manner of handling this herd hardly agrees with the method in which similar cases would be handled at the present time. In the first place, it would seem to have been unnecessary to inject virus blood into the 2 shoats that were already sick with the disease. These animals would have perhaps been better handled with the injection of a double dose of the serum and no virus blood. If temperatures had been taken in this herd it would probably have been found that several of the other hogs injected by the double method were running a high fever, and as such should receive a large dose of serum and no virus blood.

However, the results in the herd were very favorable, and speak strongly for the value of the serum method of treatment. Of the 30 shoats and 2 sows that were given the double method of treatment, every one, except the 2 shoats that were sick at the time of injection, remained well and passed through the outbreak without showing any symptoms of the disease. This goes to show that even in the presence of infection in a herd the double method of treatment can be used with safety when the serum used is of the proper quality.

The 2 shoats that were sick at the time of the injection, as well as the 5 shoats that were left untreated, all died from the disease. The death of the 2 shoats goes to show that when the disease is well established in an animal, serum, if it is to be of any benefit, must be used in large doses. It is quite possible that these 2 shoats would have died even if they had received the larger dose of serum, but I am firmly convinced that even with diseased hogs, if seen early, a large percentage of them can be saved when the serum alone is given in about double the usual dose.

The death of the 5 untreated animals leaves no question as to the severe type of the disease which was present in this case. These 5 shoats became infected by contact with the virus of the disease which was scattered about the feed lots with the bowel discharges and urine of the 2 shoats that were already sick at the time that the treatment was given.

On the whole, this experiment was a very successful one, and gives a very good idea of what can be accomplished in even a diseased herd if the treatment is given as soon as the first animals are noted to be sick.

Whenever the hogs on a farm begin to take sick without any apparent cause, such as change of feed, change of sleeping quarters, or feeding on salt brine or oil meal, and begin to die in a few days after the disease starts, it may be set down in almost every case that the disease from which they are suffering is hog-cholera, and the only chance of saving the herd is by the prompt injection with serum. The sooner the serum is given, the greater will be the number of hogs that will be saved. Every hour lost will increase the number of animals that will die.

Herd Number Ten.—This herd, which formed the tenth group of hogs treated in this experimental series, was located in the southwest quarter of Section 6, Grant Township, Story County, Iowa. The herd was already in a very bad condition when first seen, and the results which followed the use of serum here are most pleasing. The source of the infection in this feed lot could not be definitely traced, as there were no diseased herds in the neighborhood at the time.

This herd was first visited by men from the Ames Experiment Station on October 12, 1907. The report on conditions found at that time shows that 4 hogs had already died, and about half of the remaining animals on the farm showed indications of being more or less affected. The animals which were sick at this time showed the usual symptoms of cholera. They remained in their nests, showed loss of appetite, were weak in the hind legs, and many cases had already developed a diarrhea.

An old sow which had recently died was opened up and an examination of the organs made in order to make sure of the diagnosis of cholera. This was very plain, as the usual changes produced by cholera were in evidence. Changes in the liver and spleen, together with a spotting of the kidneys and the presence of ulcers in the large bowel, made the diagnosis very clear. The changes, however, were those of the chronic type rather than the acute form of the disease, and the clinical results afterward noted were those of the chronic type.

In carrying out the demonstration, 15 shoats, each weighing about 150 pounds, were each injected with 30 c.c. of hog-cholera serum. These 15 animals showed signs of being sick at the time and were given no virus blood. Ten other shoats, which were

apparently not yet affected, and which were of about the same size, received the same dose of serum, with the addition of 1 c.c. of virus blood. Three old sows, which averaged about 200 pounds each, were each injected with 30 c.c. of serum alone. Three other old sows, weighing about 400 pounds each, received 40 c.c. of serum alone. The balance of the herd, consisting of about 25 animals, were left untreated.

The results in this herd were most excellent. Only one of the treated hogs died, and this in spite of the fact that over half of those injected were sick at the time of treatment. This one animal that died was an old sow which developed a very severe abscess swelling at the point of injection, and the absorption of poisonous material from this abscess was very likely in part the cause of death.

Of the 25 animals that were left untreated as checks, 15 died—2 old sows and 13 shoats. A number of the 10 hogs that remained of the untreated 25 developed a slow, lingering type of the disease and were left stunted and practically worthless.

The disease in this herd was not of as deadly a type as has been described in some of the other herds reported in this series of experiments, and this in great measure accounts for the large number of check animals that survived. However, the results from the use of the serum treatment were most brilliant, and we can learn a few valuable points from the method followed in this case:

Here the hogs which were apparently sick received serum alone, and while the dose given in these animals was a little smaller than I would consider desirable, yet the results obtained would seem to prove that small doses of a properly made serum are capable of producing excellent results, even when the disease is quite well developed, as it was in this case. No one should hesitate to use serum, even after the disease has made its appearance in the herd, if he is certain that the serum he uses be of good quality.

In this herd the disease was well established and several animals had already died. Yet the use of the serum here stopped the disease at once in the animals so treated, only one more death occurring in the treated animals, and that probably from secondary causes rather than from cholera.

In this herd also we have an example of the proper use of the double treatment in an infected herd. In treating herds of this

kind the rule should be to give a large dose of serum in those animals that are already sick, as shown by loss of appetite, staggering gait, muscular weakness, and desire to remain in their nests, and also in those animals that do not show these symptoms, but do show a rise in temperature above 105° F. In the animals that are still free from the disease at the time of treatment and do not show any rise in temperature the better plan is to give the double method of treatment.

In following this rule we are certain of having at the end of the outbreak a herd remaining every one of which has developed the power of making in its own bodies the germ-fighting agents which will protect it from disease during the remainder of its natural lifetime.

This outbreak also serves to show very nicely the difference in course of an outbreak of chronic cholera from that of the acute type. In the chronic form of the disease the course is more long drawn out, and probably not more than 50 per cent. of the animals will die. A large percentage, however, of those which survive the attack are left in a stunted condition and are never of any account afterward. These runts are usually better knocked in the head, as they will never pay for the grain they eat.

Herd Number Eleven.—The herd which formed the basis for the eleventh of this series of experiments was located in the northeast quarter of Section 36, Grant Township. This is in the immediate vicinity of Shipley, Iowa, and was the center of an infected neighborhood at this time. The herd was first seen on October 15th, and on that date was apparently unaffected, although hog-cholera was present on other farms not over half a mile distant. In carrying out the experiment, arrangements were made with the owner to administer the simultaneous method of treatment, and later on to expose one-half of the animals to hog-cholera on an infected farm in the neighborhood.

There were 36 animals in this herd, and the treatment was administered to 35 of them. One animal got away during the time the treatment was being given, and on this account was left untreated. The 35 animals injected were shoats, averaging from 30 to 75 pounds, and each hog received 20 c.c. of serum and with this 2 c.c. of virus blood.

The final outcome in this herd was rather unsatisfactory, for some reason which apparently could not be determined. The animals injected all continued well until the morning of the 24th, when one shoat appeared droopy and refused to eat. At noon of the same day 2 other animals were noticed to be rather droopy. Word was sent to the Ames Station, and when the herd was visited on the following morning 4 shoats were showing symptoms of cholera.

On this date the entire herd was reinjected with 20 c.c. each of serum alone. On the 26th, 2 more were sick, and on the 28th, 2 were dead and 7 were sick. When seen on November 1st, 5 had died and 3 of the sick ones appeared to be much better. One more died after this date, making a total of 6 that died and 30 which survived.

One of the shoats that died was opened up and examination made for the purpose of making certain that the animals were really dying from cholera. The results of this examination left no doubt as to the cause of death. The glands in the flanks were swollen and red in appearance, the spleen was large and black in color, the kidneys showed the regular spotted appearance of hog-cholera, and everything pointed clearly to hog-cholera as the cause of death.

This is one of the very few bad results that have been reported following the use of the double treatment where the serum used was of proper quality. Just why this unusual result was met with in this case is rather hard to make out. It would seem, however, as if the dose of virus given was perhaps a little large and the dose of serum a little small. It is certainly a larger dose of virus and a smaller dose of serum than would be advisable for regular field work. However, the same serum was used here as in the previous herds mentioned in this series of experiments, and it had apparently been capable of protecting against a 2-c.c. dose of virus without any trouble.

As these animals were all young shoats, it is possible that they were more easily affected by the virus blood, and this may, in part at least, account for the undesirable outcome of the experiment.

In spite of the unfortunate result in having cholera develop, there are a number of interesting and noteworthy points to be found in this experiment:

In the first place, it shows that with an outbreak of hog-cholera in the neighborhood the use of the double method of treatment, even though it be followed by an outbreak of the disease, results in a much smaller total loss than would have been the result had the disease reached the herd in the usual manner and run the usual course of a hog-cholera outbreak. In this herd, where the disease followed the double treatment, there were only 6 animals lost out of a total of 36; a very small loss as compared with that which usually follows an outbreak occurring in the natural way.

This experiment also shows the proper method of dealing with an emergency of this kind. If for any reason an outbreak of the disease should follow the giving of the double treatment, the proper thing to do is to get a supply of first-class serum at once, and go back into this herd and reinject with serum alone. In this way the outbreak can be controlled in nearly every case and the loss kept very low.

Herd Number Twelve.—The herd which is reported as the twelfth in this series of experiments was located in the southeast quarter of Section 26, Grant Township. This was also close to the town of Shipley, and as the disease was very widespread in this part of the state at the time of these experiments, it is quite likely that infection of the herd took place from some of the nearby infected farms.

Two of the young pigs on this farm were noticed to be sick on October 12th. United States veterinarians from the Ames Experiment Station visited the farm on October 15th. At this time they found that these 2 pigs were decidedly sick, and several other animals in the herd were off feed and ailing. The animals showed the usual signs of cholera: they were droopy, remained in their nests buried under the litter, and cared little or nothing for feed.

In order to make sure of the diagnosis, the sickest of the 2 pigs was killed and the body opened up. This examination proved very clearly that the animals were really suffering from cholera. Small red spots were seen in the kidneys and on the surface of the lungs. In addition to this, there were also a number of beginning ulcers to be seen in the large bowel.

In this herd there was a total of 92 head. Of this number, 62 shoats, weighing from 35 to 100 pounds, were injected with serum

alone. Fifty-nine of these received 20 c.c. each, one received 30 c.c., and 2 received 10 c.c. each. Nine old sows, weighing from 250 to 400 pounds each, received 40 c.c. of serum and no virus. Fifteen shoats and 6 old sows were left untreated to serve as checks.

In this herd the disease proved to be of a rather mild type, as neither treated nor untreated animals died very rapidly. However, of the 15 untreated shoats left as checks, 8 finally died. There was also 13 deaths among the treated shoats. Of the old hogs, both those that had been treated and those which were left as checks remained well.

While the results from this experiment are not as satisfactory as in many other similar experiments, the outbreak is of interest in many ways.

In the first place, this case gives us another example of the fact that young hogs are always more likely to take cholera than old sows. Especially is this true in the case of the chronic or mild forms of the disease. In a real severe outbreak of acute cholera neither sows nor pigs are spared, as a rule, and it is not unusual for this type of the disease to sweep the feed lots clean.

It will be noted in this herd that while the injection of the serum did not absolutely check the disease, yet in the animals that were injected the total loss was only about 20 per cent., while in the untreated animals the loss was over 50 per cent. This, too, in spite of the fact that the herd was already sick at the time the injection was made.

The dose of serum given in this case was considerably smaller, I think, than would be used at the present time under similar conditions, and with a larger dose of the serum the death-rate among the injected animals would, no doubt, have been much lower than it was with this comparatively small dose.

Herd Number Thirteen.—The thirteenth herd in this series of experiments was located only about 20 rods from Herd Number Twelve. This herd was first seen on October 15, 1907, the date on which the animals of Herd Number Twelve were treated. The animals at this time were all apparently well, but in danger of infection from the other herd, which was located but a short distance away.

In this herd 5 small pigs, weighing about 25 pounds each, re-

ceived 10 c.c. each of serum alone. Three shoats, of an average weight of about 90 pounds each, received 20 c.c. of serum with 1 c.c. of virus blood. Five sows that had raised litters of pigs and, accordingly, were in somewhat poor flesh, each received an injection of 30 c.c. of the same serum with an accompanying injection of 2 c.c. of virulent blood. Two 90-pound shoats and 8 small pigs were left untreated, to serve as checks.

Eleven days later the owner of this herd reported that 2 of the animals which had been treated were off feed. A visit was made to the farm on October 28th, and at this time one of the animals which had seemed about to get sick was entirely recovered and the other one seemed much better. At this time, however, a third shoat was apparently becoming ill. In order to prevent a serious outbreak of the disease most of the checks and a number of the previously treated animals were given a second injection of serum alone, each animal receiving 20 c.c. of serum.

The balance of the report on these animals is not very definite, and it is a little hard to determine just how much good the serum did in this particular case. The final report on this herd shows that one animal died, but as there was no opporunity to open up the body and examine same after death, it is impossible to say whether or not the hog died from cholera or some other condition.

The report on this herd is lacking in the details that are necessary to arrive at a correct conclusion as to the effects of the serum treatment, but one important conclusion can be drawn even from the incomplete information obtained in this case, and that is, that results were very good. This herd was located in the midst of a cholera outbreak, with cholera herds located all around it, and yet passed through the outbreak with the loss of only one animal, and that without it being positively shown that this death was due to cholera.

The fact that a few of these animals showed signs of getting sick after the double treatment, and this, together with the fact that the herd was treated on the same day as Herd Number Eleven, would make it seem just possible that there was some undetermined influence at work here which caused the unsatisfactory results reported.

In this herd we again have, however, an example of the fact

that, even if bad effects should follow, or threaten to follow, the use of the simultaneous method, they can be checked by going back into the herd and reinjecting with serum alone.

Herd Number Fourteen.—This herd, which made the fourteenth one injected in this series of experiments, was located in the southwest quarter of Section 24, Grant Township. This was in close contact with many other infected herds located in this same township.

The farm was first visited on October 16, 1907. At this time the animals were all apparently in good health. The herd was a comparatively small one, consisting of 27 good-sized spring shoats.

Twenty head of these animals, weighing from 125 to 170 pounds, were each injected with 20 c.c. of serum, and also received at the same time 2 c.c. of virus blood. The remaining 7 shoats, which were of about the same average size and weight as those injected, were left as checks.

It is of interest to note that the serum used in this experiment was the same as that used in treating Herd Number Eleven, in which several animals got sick after injection. The virus used was also the same, except there was added some blood from another sick pig in order to make up enough virus to go round.

The herd remained well, both treated and untreated animals showing no change until over a month later. About November 20th some of the check shoats showed loss of appetite. On November 26th 3 or 4 of these checks showed unmistakable hog-cholera symptoms. One of the treated shoats on this date appeared to be a little off feed, but did not show any definite symptoms of hog-cholera.

The final report on this herd was made on December 18th. An examination of the herd at this time showed that 4 of the checks had died, one was very sick, and another one was sick, but showing signs of improvement. The seventh check shoat had been butchered by the owner for meat soon after the herd was treated and before there had been any appearance of disease in the herd.

Seven of the animals which had been treated were also sold between the time of injection and the appearance of the first symptoms of the outbreak. The other 13 treated animals had remained perfectly well and were in good condition at this time.

This herd gives a very good example of what may be expected from the simultaneous method of treatment.

Here a herd of 20 shoats were treated by the serum-virus method, and a month later passed through an outbreak of the disease in which they remained in the same feed lot with sick animals, and not one of them were lost. All of the untreated animals that remained at the time of the outbreak became sick, and all but one died. The treated animals did not even become sick, and none of them were lost. Had this entire herd been treated by the double method there would have been no loss whatever.

It is also worthy of note that very small doses of serum were used in this herd, as compared with the body-weight of the animals and the amount of virus blood given. Yet with a powerful serum the results were good even in this small dosage. I would not, however, recommend the use of this small dose of serum in doing simultaneous work as a regular practice. Rather use a little more than is necessary than not enough.

The question might arise as to whether or not the untreated hogs in this herd were infected from the treated animals by passage of the virus blood through their bodies and out into the feed lots with the manure and urine. I think not. The length of time which passed between the date of this injection and the date of the development of the disease in the untreated animals was too long for infection to have taken place in this way. While cholera infection may be slow in developing in some cases, it is rarely if ever so long delayed as thirty days.

The probabilities are much stronger that the infection in this case took place through virus of the disease being brought upon the place later on from some neighboring farm where the disease was present, as there was a large amount of cholera in this part of Grant Township at the time.

This experiment also gives an example of the advantage of the serum-simultaneous treatment over the serum-alone method. Had the serum-alone method been used in this case the protective power against the disease would have been run out before the outbreak really took place, and the treated hogs would, no doubt, have taken the disease as well as the untreated. By use of the double method protection is secured not only against the immediate

danger, but also against any outbreak of cholera that may take place weeks, months, or even years later on.

On account of the fact that the same serum was used in this herd as was used in Herd Number Eleven, it makes the results in the last-mentioned herd the harder to explain. It seems that either there must have been some slip in the manner of giving the serum in the Number 11 Herd or else the animals on that farm simply were born with an unusual tendency toward cholera.

Herd Number Fifteen.—This herd, forming the fifteenth in the series of experimental injections, was located in Section 3 of Union Township, close to the town of Shipley, Iowa. This farm was located in close contact with infected herds, but when seen on October 16, 1907, there was no evidence as yet of the presence of the disease in the drove. The herd was quite a large one, consisting of about 70 head, most of them being small summer shoats. The manner of handling this herd was as follows:

Thirty-eight small pigs, each weighing about 30 pounds, were each injected with 10 c.c. of serum alone. Twelve larger shoats, weighing about 60 pounds each, received 20 c.c. of the same serum. Seven old sows, of about 250 pounds weight, were each given 40 c.c. of the same serum plus 2 c.c. of the virus blood.

Two old sows and 11 shoats, weighing from 30 to 60 pounds each, were left as checks.

The results of this experiment were not quite as interesting as some others, as there was no sickness seen in either the untreated or treated animals. Accordingly, the conclusion must be reached that no infection reached this herd at all.

The experiment is of interest, however, in that it again gives an example of a herd in which the double method of treatment was used on a part of the animals without producing any bad effects in the untreated animals. In this case the old sows received both serum and virus, and yet we had no development of cholera either in the treated or untreated shoats, and this in spite of the fact that these shoats were just at the age when they would be the most easy to attack by cholera.

The argument that using the double method of treatment results in spreading of infection to other animals that are not so treated seems to lack proof in this series of experiments. Espe-

cially does this hold true in those cases where a sufficient dose of serum is given with the virus to fully protect the animal, and prevent any of the treated animals from developing any signs of illness.

With a properly made serum and a reliable virus I do not think there can be any question but what it can be given with perfect safety, if the dose of the serum is made large enough to afford proper protection against the dose of virus used. It will be noted that in practically all the experimental herds treated in this series the dose of virus used was double that usually given, while the doses of serum given were not quite up to the doses usually recommended for animals of the same weight. These herds, then, are an unusually severe test of the efficiency of the serum as a protection against the development of infection following the use of virus blood, and the few unfavorable results recorded are, in my opinion, as much due to this fact as any other.

It is plain that the resistance of all hogs to cholera is not the same. Some individuals take the disease more readily than others. With herds that have a very weak resisting power to the disease, as in the case of the animals described in Herd Number 11, it is plain that the injection of a large dose of virus with a small dose of serum would be likely to produce disease that would not occur if a smaller dose of virus was given and a large dose of serum.

Herd number sixteen of this experimental series was located in Section 23 of Grant Township, Story County, Iowa. The herd was made up of a number of old sows and shoats, running all sizes and ages.

This herd, as in the case of a number of those just described, was located in the center of an infected district. The experiment was started on this farm October 16, 1907. At this time the appearance of the herd was good, and there was no sign of cholera in any of the animals.

Thirty-five shoats, whose average weight was about 80 pounds, were injected with 20 c.c. each of serum, plus 2 c.c. of virulent blood. The virus blood used in this herd was the same as that used in Herd Number 14. Seven more shoats, with an average weight of 40 pounds, received each 20 c.c. of serum with no virulent blood. Fifteen small shoats, weighing 25 pounds each,

received 10 c.c. of the same serum. Three large spring shoats, weighing 150 pounds, and 13 old hogs, weighing 300 to 450 pounds, were treated with 40 c.c. each of serum, plus 2 c.c. of the virulent blood.

Four old sows and 10 shoats of various sizes were left as checks.

This farmer was evidently not entirely confident of the effects that might follow the use of the serum, for he began, as a further precaution against the disease, to feed the animals with copper sulphate, or, as it is commonly known, blue vitriol. The bad effects which followed were probably due in a large measure to this fact.

The checks and treated hogs went along all right until October 25th, when some of the animals which had been treated seemed to be off feed. Word was sent to the station at Ames and the herd visited on October 28th. At this time one of the treated shoats had just died and another one was nearly dead. The animal which was about dead was killed, and the two bodies opened up. The same type of change was seen in both cases. In each body the spleen was very much enlarged and filled with blood. This was about the only important change that could be seen. One body showed a few spots on the lungs, and the other showed the presence of a considerable amount of fluid in the lungs. No spotting of the kidneys or ulcers in the bowels are reported.

In addition to the 2 that were killed there were 2 or 3 others sick at this time. All of these animals had received the simultaneous method of treatment. The check animals all appeared well.

By November 1st 5 of the treated animals had died and 2 more were sick, while all of the checks remained well. Later on 2 of the checks died, but in neither case was it possible to make a trip to the farm and open up the bodies to find out the cause of death.

The results obtained in this herd are just a little confusing, and it is somewhat hard to arrive at conclusions as to the actual results.

While it is true that several of the animals which were given the simultaneous treatment did take sick and 5 of them died, yet the findings, on opening up the dead bodies of the animals which

died, do not confirm the diagnosis of hog-cholera as the cause for death.

Further doubt as to the actual cause of death in these cases is caused by the fact that this farmer fed the animals an irritating poison, in the form of copper sulphate, after the administration of the treatment. It is very easy to see how the giving of this irritating drug could so lower the strength of the animal that the effects of the drug when combined with the effect produced by the injection of virus and serum would cause death. This, it appears to me, is the most reasonable conclusion as to the cause of the loss of these 5 animals. The injection of the double treatment must of necessity cause a certain amount of reaction in the body of the animal, and where this treatment is given it is proper to issue certain precautionary warnings as to necessary regulation of diet and care of the animals for a week or ten days immediately following.

It would seem that in this case the body of the animal was somewhat lowered in strength by the action of the double treatment given, and when on top of this we add the action of the copperas, it was a little more than the animal could stand, and death was only a natural result.

As further evidence that the disease or condition which caused death was not hog-cholera we have the report that the untreated animals were not affected to any marked extent.

If the condition were really hog-cholera, and it was sufficiently death-producing in nature to cause the death of the animals which had been injected with serum, it would have most certainly spread to the unprotected animals in the herd.

While the report on this herd is not complete enough to lead to an exact diagnosis as to the cause of losses in the herd, I do not think that the trouble can be justly laid to the double method of treatment. The real fault, I think, lies in the feeding of the copper sulphate.

The case in this respect teaches a lesson of importance to those who may engage in the giving of serum treatment for hog-cholera. Never neglect after completing the work to carefully instruct the owner as to the proper care of the animals for the next few days.

Leave instructions to feed but very lightly for the first few days immediately following the injection, and under no consideration

should anything be fed that may produce irritation of the stomach and bowels, diarrhea, or indigestion. No drugs, sour swill, or other like substances should be given.

Also leave instructions that no surgical operations, such as castration, ringing, spaying, or anything of that nature, are to be attempted for a least ten days or two weeks after the injection of the serum. It is also a wise plan not to give the serum or serum-simultaneous treatment, and especially the latter, for at least two weeks after the animals have been castrated.

Herd Number Seventeen.—The herd which formed the basis of the record for the seventeenth of these experimental reports was located in the northeast quarter of Section 3, Union Township. The herd was apparently well when treated on October 17, 1907. Hog-cholera, however, was prevalent on the adjoining farms, and there was constant exposure to danger of infection.

In carrying out the experiment at this farm 27 head of shoats, averaging 100 pounds or over in weight, were injected. Each of these animals received 20 c.c. of antihog-cholera serum, and at the same time were injected with a dose of 2 c.c. of virulent blood. Six shoats of about the same average weight were left to serve as checks.

This herd was again inspected by representatives of the bureau station on October 28th. At this time one of the check shoats showed symptoms of cholera. This shoat died a few days later, and it was not long until the other checks in this lot became sick with symptoms of cholera. The herd was again seen on November 26th, and at this time 3 of the checks had died. December 19th, when the final report on this herd was made, 5 of the 6 check shoats had died and the remaining 1 was sick.

At no time during this experiment did any of the hogs which had been treated show any evidences of being sick, but all remained well and thrifty throughout.

In this herd we have an excellent example of what may be accomplished with the use of the simultaneous or double treatment in preventing the outbreak of cholera in a healthy drove. In this herd the animals that received the double treatment remained well not only during an outbreak on the surrounding farms, but also remained perfectly healthy despite the fact that the disease in-

vaded the same feed lot in which they were located and destroyed the untreated animals.

If a hog is properly immunized by means of the serum-virus combination treatment he is protected for all time against the disease, and will not be made sick by hog-cholera, no matter how much or how often he may be exposed. As in the case of the herd just described, the disease may be present in the same feed lot in which the treated animals are kept, and untreated animals may die all around them, but the animals which have been given the simultaneous method remain healthy. This holds true no matter how long after the giving of the treatment they may be exposed.

It can be easily seen from this that the double method is the method of choice in the handling of herds that have been exposed to the disease, or which are located in a neighborhood where the disease is present. It is by the use of this method of treatment that we will be able to prevent the spread of the disease in a community and save thousands of hogs in every county in the United States.

If all the animals in this herd had been treated the disease would never had made its appearance in the herd at all. Of course, these herds were injected for experimental purposes, and it was necessary to leave some animals untreated in order that the men in charge of the work might have an opportunity to draw conclusions as to just what the treatment would do. In actual field work, of course, all the animals in the herd should receive the treatment.

The only danger in the giving of the virus treatment lies in the use of a poor grade of serum. The sreum used must be of tested quality. Be certain of your serum, and then, by using ordinary judgment in handling the dosage, only the best of results will follow.

Herd Number Eighteen.—The eighteenth herd treated in this series of experiments was located in the northeast quarter of Section 3, Union Township. The herd was located in a neighborhood in which the disease was widely scattered, and this farm was surrounded by a number of disease-infected farms.

At the time of treatment, which was on October 17, 1907, the animals were all apparently well. The herd was of the usual mixed

type to be found on the average farm, and consisted of old sows, large spring shoats, small shoats, and sucking pigs.

Forty-four shoats, averaging about 125 pounds, were injected with the simultaneous treatment. Each animal received 30 c.c. of serum and at the same time was injected with 2 c.c. of virus blood. Six shoats, weighing 80 pounds each, were injected with 20 c.c. of serum and 2 c.c. of virus blood. Two boars, weighing about 150 pounds each, received 40 c.c. of the same serum and 2 c.c. of virus blood. Four pigs, weighing about 30 pounds each, were injected by the single method, each pig receiving 10 c.c. of serum without any virus blood. Ten small sucking pigs were also treated by the single method, receiving 10 c.c. each of serum. Nineteen old hogs were injected by the double method, each one receiving 40 c.c. of the serum plus 2 c.c. of virulent blood.

One old sow, 12 shoats of various sizes, and a few of the sucking pigs were left untreated, to be used as checks.

This entire herd remained well for a considerable length of time after the treatment was given, infection apparently not being carried to the farm. In accordance with arrangements previously made with the owner of the herd, 3 of the untreated checks and 11 of the larger treated shoats were moved to the farm of a neighbor where cholera had been present. These hogs were placed in the same feed lots where the disease had been present and where other hogs had died. There were some shoats in the feed lot at the time which were sick with cholera.

Within a few days the 3 untreated checks took the disease and 2 of them died. The third one finally recovered.

The 11 treated shoats remained perfectly well, with the exception of one, which was found dead in the feed lot the day after they were placed there. The cause of death in the case of this animal was never determined, as it was impossible to return at that time and open up the body. It is almost certain, however, that the cause of death was not cholera, as the animal appeared to be in perfect health the night before, and cholera would not develop and cause death that rapidly even in an untreated animal. It is more likely that the animal was killed by fighting with the strange hogs with which it came in contact in this new feed lot.

Within a short time after the 14 hogs had been moved from the

home farm the disease broke out there, infection having been carried to it in some manner. The disease broke out first among the untreated checks, and 5 of the 10 untreated animals that remained on the farm died of the disease in a few days after it made its appearance.

Of the treated pigs which received the serum alone, one of the 4 30-pound pigs and 5 of the 10 sucking pigs died of the disease.

The untreated sucking pigs which were left as checks, and some other sucking pigs that were born after the treatment had been given, all took the disease and died, with the exception of 2.

The results obtained in this herd are, indeed, most instructive, and give us a large number of practical lessons in hog-cholera and methods of handling the disease.

In the first place, it shows that a herd of hogs may remain healthy even in an infected district for a long period of time if there is no direct communication with other farms, by means of which the disease-producing virus may be brought upon the premises.

In this herd a large part of the animals received the double method of treatment, some of them received the serum alone, and others were left untreated. Yet we have no outbreak of the disease in this herd which could be laid to the giving of the double treatment. This is another example of the perfect safety with which the double method of treatment may be given. The danger of infecting the premises or producing the disease in other untreated animals which may be left on the place or afterward brought into the feed lots is largely an imaginary one. Where such a result does follow, it is either due to the fact that the serum used in giving the treatment was worthless or else is due to the fact that the man who injected the virus, and was responsible for handling it, was careless and allowed it to become scattered about on the ground, where it could be picked up by other animals or tracked away on the shoes of a neighbor to his herd.

The disease which broke out in the home herd was no doubt due to the carrying of infection from the neighbor's feed lot by the men who helped to move the hogs that were taken to this diseased farm for experimental purposes. This gives a good example of the extreme care which must be used in going into a feed lot or on a farm where hog-cholera may be present. It is very easy, indeed,

to carry back with you on your shoes some of the germs of the disease and scatter them in your own hog lot, with the result that hog-cholera will later occur.

The danger from this source is aptly emphasized by Dr. Balcher, of Newcastle, Indiana, who, in a recent speech before a veterinary gathering, sums the danger up in this manner:

"Don't allow your hired man even to go and visit your neighbor's hired girl unless he takes off his shoes before going in and washes and disinfects his feet before coming away."

The results which followed the moving of the treated and untreated hogs to the farm where the disease existed illustrates two facts of importance about hog-cholera:

In the first place, it shows us that we absolutely cannot bring unprotected healthy hogs into a diseased feed lot without losing the most of them from the disease.

On the other hand, animals that have received the double method of treatment can be moved to a feed lot and placed in the same pens and fed out of the same troughs with the diseased animals and they will not take the disease. This is of enormous importance when we are considering the bringing in of any new stock. Frequently after an outbreak of cholera has cleaned out a drove of hogs it is desired to bring in other swine to replace those that have been lost. This is especially likely to be the case where cattle are fed as well as hogs. A herd of cattle can hardly be grain fed with profit unless a drove of hogs are kept in the same feed lot.

If we bring in untreated animals in this way and place them in the lots where other hogs have recently died, the result will almost invariably be further loss, as the new animals will get the disease as a result of taking in with the air they breathe and the food they eat the virus which has been left in the feed lots by the former herd.

On the other hand, if we first have the newly purchased animals treated by the double method and then bring them in we can rest assured that no bad results will follow. If the animals be properly treated with a reliable serum and an active virus they will have an absolute protection against the disease, and it would be impossible to cause cholera in them even if we were to inject enormous doses of pure hog-cholera virus into their bodies.

This fact is also of importance in case we are about to ship animals away for exhibition at stock shows or fairs. It very frequently happens that the pens at these fairs become infected with cholera virus, or an outbreak of cholera may occur in the animals which are being shown in the very next pen to your own. In this case if your animals are unprotected you are almost sure to suffer a severe loss from the outbreak of the disease in these high-priced animals. The worst feature of this matter is the fact that your animals may not get sick until after you have taken them home and placed them back in the feed lots. In this case you not only are likely to lose the show animals, but the disease will spread to other hogs in the herd, and a loss of several thousand dollars is not unusual in thoroughbred herds following an outbreak brought in in this manner.

This danger can be entirely avoided if the animals which are to be used for show purposes are first given the simultaneous method of treatment. In this way they are absolutely protected against the virus of cholera, and no amount of exposure in infected pens or by coming in contact with sick hogs will cause them to get sick.

In the case of the outbreak at the home place, which occurred after the removal of part of the animals to the infected farm, there are also a number of very valuable points of interest. The most likely manner in which the disease reached this herd has already been pointed out. The infection was no doubt carried back to the farm at the time when the 14 experiment animals were moved to the farm of the neighbor where hog-cholera already existed.

In the outbreak at the home farm it is particularly worthy of note that the younger shoats and the sucking pigs were among the first to show the disease, and also that they were the most severe sufferers from the outbreak. This only serves to bear out the statements that have been previously made in this work, to the effect that hog-cholera is especially likely to break out where sucking pigs or young shoats are exposed to infection.

Very good examples of this are to be found in cases where a herd of hogs is kept in a pasture along a public roadway. The young pigs will almost always find a hole in the fence through which they can crawl and get out into the road. It is very common

for wagons hauling diseased and exposed hogs to pass along these same roadways and leave behing them a trail of infected bedding, manure, and other disease-carrying material. These young pigs, in rooting around, come in contact with the disease-carrying substances, and it is not long until they begin to show signs of the disease. An outbreak that sweeps through the entire herd soon follows.

The much higher death-rate which occurred in the sucking pigs as compared with the older shoats is also a common occurrence in cholera. The younger the animals, the more easily they become infected, and also the more easily do they die from the disease once it makes a start in the herd.

In connection with the results of the outbreak in the treated animals there are also some points that help to make clear a number of things which have been already said about the use of serum.

In these animals we again find that double the usual dose of virulent blood with even a little less than the usual dose of serum was used, and yet no bad results followed. This is certainly strong proof of the fact that where only a 1-c.c. dose of virulent blood is used and a larger dose of serum employed the danger is practically nothing. This, of course, providing that the serum used be of good quality. This point cannot be too strongly emphasized. The quality of the serum is absolutely all important where the double treatment is to be given. Double treatment with a poor grade of serum means that there will be a lot of funerals.

It must not be understood by the frequent references here to poor-grade serum that only commercial serums are meant. It is by no means always true that serum made by commercial firms is of low grade. Some of the best serum made in this country is made by commercial manufacturers. Some of the most expert men in the United States are employed in the manufacture of hog-cholera serum for commercial firms. On the other hand, the state laboratories by no means always turn out a perfect serum. The salaries paid by state institutions are not large enough to attract the very best grade of workers to this field. A high-grade serum maker can secure more salary working for a commercial firm, as a rule, than he can for a state experiment station.

Many excellent men remain in the state service more on account of their desire to do a public service to the people of their state, rather than for the salary which they are able to obtain in the employ of the state.

However, it cannot be denied that there are a number of commercial firms that are in the serum business merely for the money there is to be made out of it, and they are willing to sacrifice quality and purity of their serum in order to increase the percentage of profit and increase sales by making a cheaper priced serum. Beware of the low-priced serum. Good serum cannot be made and offered at a low price. This is one of the recognized drawbacks in the manufacture of serum to-day, and both state and private laboratories are straining every effort to devise a method of growing virus outside the animal body for the purpose of lowering the cost of the product.

It is decidedly interesting to note, in connection with what has already been said in previous pages of this work, the results following single and double treatment in this herd. It will be recalled that it has been repeatedly pointed out in the preceding pages that the protection given by the single treatment was only temporary, and that it was lost as soon as the effects of the serum injected at that time had worn off.

This single method of treatment does not educate the cells of the animal body to manufacture antibodies, and without these antibodies there can be no protection. On this account we are not surprised to note in this herd that the small shoats and little sucking pigs had lost their immunity or protection, and were victims of the outbreak of cholera which did not occur for several weeks after the serum had been given.

This will practically always be found to be the case where the single treatment is used. The protection is strong immediately following the use of the serum, but it passes off in from three to eight weeks, and the animal again becomes susceptible to the disease unless retreated.

The young pigs were given the single treatment in this case because they were too young to use the double method to good advantage. It will be remembered that the statement has already been repeatedly made that the double treatment, when used in

very small pigs, does not give a permanent protection. The proper treatment in the little fellows is serum alone, this to be followed a few weeks later by the double method.

It is very pleasing to note that in the case of the animals which received the double treatment and remained in the home herd there was no loss whatever. The immunity given by the double method of treatment which was used here several weeks before gave a permanent protection. This is the great advantage offered by the double method. Protection given by this method is life-long, and no matter when the animal may be exposed to the disease, there should be no loss if the treatment is given with a powerful virus and a properly tested serum.

It is interesting to note, in summing up this experiment, that of the hogs treated by the serum-simultaneous method, only one died, and this one undoubtedly died from some other cause than cholera. Of the 12 untreated check shoats, 7 were lost. The fact that 50 per cent. of the serum-treated sucking pigs were saved goes to show that, even at this late date, there was still some protective power remaining from the use of the serum alone.

Careful consideration of this report also brings out another point of interest, and answers another frequent question in connection with the giving of the serum treatment, and especially the giving of the double treatment.

It will be noted that some of the treated sows gave birth to litters of pigs after they had been treated. It has frequently been argued that there is danger in giving the serum treatment, and especially the simultaneous treatment, to pregnant sows, as they are likely to abort. The results in the herd just described would tend to disprove this assertion.

Personally, I am of the opinion that there is absolutely no danger in the administration of either the serum or the serum-simultaneous methods of treatment in pregnant sows, provided care is used in handling them not to cause too much straining, bruising, or other rough handling, which might result in causing an abortion. As far as the action of the serum itself or the serum and virus combined is concerned, I do not believe that they are in any way likely to cause abortion.

If careful investigation were made of a number of cases where

abortions have followed the use of the serum or the serum-virus treatment, I think it would be found that in the majority of these cases either rough handling at the time of treatment was the cause of the abortion, or else that the animals had a high temperature at the time of injection, and that they really had a mild attack of cholera which was checked by the serum. The cause of the abortion in this last case was the high temperature caused by the cholera infection, and not due to any action in the body on the part of the serum or the serum and virus when given together.

Dr. Fitzgerald, of the Ohio State Experiment Station, reports a large number of cases of injection by both the single and double method of pregnant sows, and the number in which an abortion took place was very small, and can be explained in most cases by rough handling or natural causes which frequently cause abortion in the sow.

As a preventive against the possible occurrence of abortion in sows, it is advisable to manage them in a quiet manner, and by some means which will require the smallest possible amount of handling. The best method of dealing with these pregnant sows is to use a rope with a noose in it and slip this into the mouth back of the tushes. Then draw up the noose and fasten the rope by taking one or two turns around a convenient post, trees, wagon-wheel, or anything else that is handy. The injection should then be made in the space behind the ears, and the animal loosened by unwrapping the rope from around the post or tree and loosening up the loop in the rope. The sow will quickly shake her head loose from the rope.

In connection with those pigs which were born of the treated sows it is interesting to note that they do not appear to have had any protection against the disease. As a rule, pigs which are born of an immune sow are born with an immunity or protection against the disease which lasts for several weeks.

In the case of the sows just mentioned, they evidently were already well along in pregnancy at the time that the injection was given, and the immune bodies had not been sufficiently well developed at the time of farrowing to confer an immunity to the pigs.

If these same sows were again used for breeding purposes in the

fall, the pigs that would be born the following spring would have a protective power against cholera which would last for several weeks. This immunity that is gained by pigs coming from a mother that has received the double treatment or that possesses an immunity as a result of an attack of the disease is a little indefinite in the length of time that it will last. Some men, such, for instance, as Dr. Dorset, of the United States Bureau of Animal Industry, and Dr. Fitzgerald, of the Ohio State Experiment Station, claim that this immunity lasts just about as long as the pig sucks the mother.

Other authorities claim that just as soon as the little pigs begin to nibble about the yards, and take to eating infectious material, they will become susceptible to the disease, and should, accordingly, be injected with serum at about the age of three weeks. This is one of the questions in regard to immunity produced from simultaneous treatment that needs a little more careful investigation.

In connection with the danger from injection of virus and serum into pregnant animals as a cause for abortion some very interesting facts have come to my notice in connection with the use of pregnant sows in serum plants. In a number of serum plants sows which have been purchased for use in the manufacture of serum have proved to have been pregnant at the time of purchase. These animals are given the double treatment at the serum plant, and three to four weeks later are again injected with an enormous dose of virulent blood, for the purpose of producing a hyperimmunity. Yet, in these cases it is very seldom that the sows abort, despite the fact that they are twice injected with virus blood, once protected by a simultaneous injection of serum, and the next time with only the protection afforded by the germ fighters formed in their own body.

These results would seem to indicate that the serum treatment by either the single or double method is practically harmless as far as any danger of producing abortion is concerned.

In connection with these pigs born at serum plants it is of interest to note that the immunity which they possess is very weak, if in fact, they possess any at all. In a number of cases where these little fellows are kept around the plant they will develop cholera in about two or three weeks as soon as they begin to nibble food

about the yards. It would seem in these cases, as in the case of the pigs mentioned in the herd which formed the basis of this eighteenth experiment, that the giving of even the double treatment during the period of pregnancy does not result in the development of an immunity in the pigs which are at that time in the uterus of the mother. On the other hand, if these same sows are again bred and allowed to bring forth a litter of pigs, this second litter will have an immunity which lasts up to about the time of weaning.

As a matter of interest, I recall an unusual case reported by Dr. Balser, of Newcastle, Indiana, in which he gave a pregnant sow the double or simultaneous injection, and a few weeks later the sow gave birth to a litter of living pigs which were suffering from cholera at the time of birth. The question arises, Were these pigs infected while in the uterus of the mother by the injection of the virus used in giving the double treatment? I think not. I think it more likely that the mother of these pigs was, in reality, developing an attack of cholera at the time the treatment was given. While there may have been no visible signs of the disease at that time, I think the germs of cholera were already in the body of the sow and that she was undergoing the incubation period.

The injection of the double treatment was sufficient to check the progress of the disease in her body, but was not able to reach the virus, which had probably already penetrated to the circulation in the uterus and had reached the unborn pigs. As a result, the mother did not develop an attack of cholera, but the pigs were not reached by the injection, and they went ahead and developed the disease, being born with it.

The results following injection of pregnant sows at serum plants not only with small doses of virus, such as are used in giving the double treatment, but also later on with doses of over one thousand times this size, without the production either of abortion or signs of disease in the pigs, is pretty strong evidence that it is not possible or, at least, not likely for the disease to be caused in this manner.

Herd Number Nineteen.—The herd which is reported as the nineteenth in this series of experiments was located in the southwest quarter of Section 36, Milford Township, Story County, Iowa. This farm was located only about three-quarters of a mile from

Herd Number Ten, previously reported. This herd was visited on October 18, 1907, and at that time was apparently well and in good condition. As it was desired to test the effects of the serum treatment in preventing the spread of the disease from infected herds, it was decided to treat this herd as a protection against the possibility of spread of the disease from Herd Number Ten.

There were 18 shoats in this herd which would average about 125 pounds in weight. Each of these received an injection of 30 c.c. of serum and, at the same time, were given 2 c.c. of virulent blood. Sixteen more shoats in the herd, weighing from 60 to 90 pounds each, were injected with 20 c.c. of serum and the same dose of virulent blood as that given to the larger animals. There were no checks left in this herd.

After-results in this herd were excellent. Not one of the injected animals became sick, and they remained well and thrifty throughout the balance of the season, in spite of the fact that they were in close contact with a herd where the disease was present.

The results here are encouraging. They again give us proof of the fact that the double method of treatment can be given without danger if the serum be of good quality. In this herd a total of 34 animals were injected. The dose of serum used was about 10 c.c. smaller than that usually recommended for animals of the same weight, and the dose of virus blood used was double that which is now recommended for animals of this weight. Yet the results were excellent. A first-class serum will protect in this dosage from much larger doses of virulent blood than are ordinarily used. When virus is used in the dose recommended in this book, and protection given by a dose of serum of the size recommended herein, the danger is absolutely reduced to the minimum. The immunity which is produced by the smaller dose of the virus is just as powerful as that produced by the larger dose. All the cells of the body need is a sufficient dose of the virus to give them a thorough stimulation, and they will actively take up the work of forming the germ-fighting agents known as antibodies. Once the body starts to manufacture these soldiers of defense against infection, the army of them that will be put in the field will be far more than sufficient to protect against the usual amount of infection which might enter the ordinary channels of entrance.

It is highly probable that had 2 or 3 animals been left in this herd to act as checks they would have developed cholera and died of the disease. This would, in a way, have added interest to the experiment, as it would have shown absolutely that the treatment was protective and prevented the treated animals from becoming sick. However, the experiment is a valuable one, in that it serves to add to our confidence in the ability to give the simultaneous injection of serum and virus without producing any harmful results.

Herd Number Twenty.—The herd which was used as the basis for the twentieth in this series of experimental injections of serum was located in the southeast quarter of Section 20, Richland Township, Story County, Iowa. This part of Story County is a considerable distance from the herds located in Union and Grant townships, which have been described in the previously mentioned experiments. While not in the neighborhood of any of the infected herds already mentioned, this herd was, nevertheless, in an exposed position, as there was cholera present on a farm but a short distance away.

The animals in this herd were first seen on October 18, 1907. At this time the appearance of the herd was a little suspicious. It could not be said that there was any evidence of hog-cholera, and yet the appearance of the animals was not the natural thrifty look that is seen in healthy hogs.

In carrying out the experiment in this herd the following plan was followed:

Twelve old hogs, which were of the average size for full-grown animals, were injected with 40 c.c. each of serum and with a 2-c.c. dose of virulent blood. Fifteen shoats were also injected in this herd. These shoats weighed, on an average, from 50 to 120 pounds, and received an injection of 20 c.c. each of serum without any virulent blood. Ten sucking pigs received an injection of 10 c.c. each of serum alone without any virulent blood.

Two old sows, 2 shoats, weighing about 100 pounds each, and 6 sucking pigs were left as checks.

The herd continued well until about November 10th, when the untreated checks began to show indications of disease. All of the untreated animals finally became sick, and they all eventually died,

with the exception of one of the 100-pound shoats. This animal appeared to have considerable resistance against the disease, as he did not even show signs of being sick.

The animals that died showed the usual symptoms of hog-cholera, but, as this herd was a considerable distance from the Ames station and an even greater distance from the other herds that were under observation, it was impossible for the men engaged in the experimental work to make a return trip and open up the bodies of any of the dead animals in order to make sure that the disease really was cholera.

None of the old hogs that had received the double treatment became sick. Out of the 15 shoats which were injected with 30 c.c. of serum and 2 c.c. of virulent blood there were 8 that became sick. Three out of this 8 finally died. The other 5 recovered. In connection with these 8 treated animals, the owner reports that the symptoms they had were not those of hog-cholera, and he did not believe that they really died from cholera. It is unfortunate, on this account, that the station experts were unable to make a second trip to the farm at this time and open up the bodies of some of these dead animals for the purpose of definitely deciding whether or not the cause of death was hog-cholera. In view of the fact that the animals appeared to have something wrong with them at the time they were treated, it would seem very probable that there was some other disease than cholera present which accounted for the deaths in the treated animals.

Of the 14 head of small shoats and pigs which were injected with serum alone, all died but 1. This is explained by the fact that the disease did not make its appearance in the herd until nearly a month after the date on which the serum was injected. The protection given where the serum alone is used is only temporary, and begins to disappear at the end of three or four weeks. This was the case here. At the time the disease invaded the feed lot the serum had lost its protective power in these animals, and as they had had no virus blood to stimulate in their system the formation of germ-fighting bodies they were left unprotected.

In the case of the old hogs that were injected by the double method, the protection created here was permanent, and they were able to pass through the outbreak without showing any signs of

than to try and save money by cutting down the dose below the point of safety.

The outbreak gives a good example of just what should be done in similar cases. If, for any reason, an outbreak of hog-cholera should occur after giving of the double treatment, go right back into the herd with a fresh supply of high-grade serum and reinject the entire herd. In the case of those animals that already show signs of disease give a double dose of the serum. In this manner it will often be possible to check the outbreak before it gets any headway and thus save the threatened loss. In these cases, unless you are absolutely certain of the quality of the serum used the first time, a fresh supply of a dependable serum should be secured for this second injection. Remember that where cholera follows the use of the double treatment the trouble in almost every case is due to the fact that the serum used was not up to standard, and did not give protection against the virulent blood.

Herd Number Twenty-two.—The twenty-second herd used in this series of experiments to determine the value of the serum method of treatment was located near the station of the Bureau of Animal Industry at Ames, Iowa. This herd also was within a quarter of a mile of the diseased herd which was described as Herd Number Ten in this series of experiments.

This herd was first visited on October 19, 1907, and at that time the animals seemed well with the exception of one shoat, weighing about 60 pounds. A few of the sucking pigs also seemed to be not just as they should. The sick shoat showed loss of appetite, looked gaunt, and had evidences of some respiratory trouble. With the idea in mind of preventing the possible spread of the disease to other herds the entire drove was given treatment. In the herd at this time there were a number of old hogs, spring shoats, and also summer and early fall pigs.

Eight old hogs were treated, each receiving 40 c.c. of the serum plus 2 c.c. of virulent blood. Twelve shoats, which weighed, on an average, about 125 pounds each, received about 30 c.c. of the serum with 2 c.c. of the virulent blood. Thirty-three shoats, weighing about 100 pounds each, received 20 c.c. of the serum plus 2 c.c. of virulent blood. Seven small shoats, weighing about

was necessary to leave nearly 50 of the animals untreated to serve as checks.

In about one week after the administration of the treatment the old sow began to show symptoms of disease. At about the same time 2 of the injected shoats began to develop a diarrhea and showed a loss of appetite. The old sow died on October 28th, just ten days after treatment was given, and when the body was opened up after death all the changes typical of hog-cholera were seen. There was some redness over the skin, especially on the skin of the belly and neck, bright red spots on the surface of the lungs, spleen very much enlarged and dark in color, liver was congested, kidneys swollen, and showing the usual turkey-egg spotting, bright red color of the lining membrane of the large bowels, and general enlargement and softening of the lymphatic glands.

On the same date that this animal died the entire herd was retreated, this time with serum alone. At this time not only those animals which had been treated at the first visit, but also the 50 other animals on the farm were injected. In the case of the 2 sick shoats the dose of serum given was 60 c.c. to each one. The other animals in the herd received from 20 to 30 c.c. each.

The results which followed this second injection with the serum alone were most pleasing. The 2 sick shoats quickly improved and went on to recovery. No more of the herd became sick, and the threatened outbreak was promptly stopped.

The results in this herd would seem to show that the old sow and the 2 shoats became sick as a result of the simultaneous treatment. In my opinion, the cause for this outbreak in these 3 animals was the fact that the dose of virus given was over-large and the dose of serum was rather low as compared to the doses we now recommend. There is also the possibility that these animals were especially susceptible to hog-cholera, and on this account developed the disease under conditions where other animals would not have been effected. This only serves to impress upon us the fact that we must not get careless in any way in handling this double method of treatment. We must especially use care in regulating the dosage in order that we may always play on the safe side. It is better to give a little too much serum

than to try and save money by cutting down the dose below the point of safety.

The outbreak gives a good example of just what should be done in similar cases. If, for any reason, an outbreak of hog-cholera should occur after giving of the double treatment, go right back into the herd with a fresh supply of high-grade serum and reinject the entire herd. In the case of those animals that already show signs of disease give a double dose of the serum. In this manner it will often be possible to check the outbreak before it gets any headway and thus save the threatened loss. In these cases, unless you are absolutely certain of the quality of the serum used the first time, a fresh supply of a dependable serum should be secured for this second injection. Remember that where cholera follows the use of the double treatment the trouble in almost every case is due to the fact that the serum used was not up to standard, and did not give protection against the virulent blood.

Herd Number Twenty-two.—The twenty-second herd used in this series of experiments to determine the value of the serum method of treatment was located near the station of the Bureau of Animal Industry at Ames, Iowa. This herd also was within a quarter of a mile of the diseased herd which was described as Herd Number Ten in this series of experiments.

This herd was first visited on October 19, 1907, and at that time the animals seemed well with the exception of one shoat, weighing about 60 pounds. A few of the sucking pigs also seemed to be not just as they should. The sick shoat showed loss of appetite, looked gaunt, and had evidences of some respiratory trouble. With the idea in mind of preventing the possible spread of the disease to other herds the entire drove was given treatment. In the herd at this time there were a number of old hogs, spring shoats, and also summer and early fall pigs.

Eight old hogs were treated, each receiving 40 c.c. of the serum plus 2 c.c. of virulent blood. Twelve shoats, which weighed, on an average, about 125 pounds each, received about 30 c.c. of the serum with 2 c.c. of the virulent blood. Thirty-three shoats, weighing about 100 pounds each, received 20 c.c. of the serum plus 2 c.c. of virulent blood. Seven small shoats, weighing about

30 pounds each, were given 20 c.c. of the serum and 1 c.c. of virus blood. Thirteen small sucking pigs were injected with the serum alone, receiving 10 c.c. each of serum.

Within two or three days after the treatment some of the sucking pigs began to show unthriftiness, loss of appetite, and other signs of disease. Several of the smaller of these pigs finally died, and, on being examined postmortem, showed the usual evidences of hog-cholera, the dark-red spotting of the kidneys being quite prominent. The shoat that was sick when treated finally died, and another shoat, which did not appear to be sick at the time of treatment, developed a marked swelling of the abdomen and finally died. The balance of the herd suffered for some time with a more or less troublesome cough, but none of them died.

The fact that several of the pigs became sick within a day or two after the administration of the treatment would indicate that this herd was just beginning to come down with cholera at the time of treatment, and the giving of the treatment unquestionably saved the lives of a large number of the animals.

This herd gives a good example of what may be accomplished in a herd where cholera is just starting by getting in at once with properly prepared serum. The usual loss in a herd of this size from an outbreak of cholera would have been at least 50 per cent. of the herd. Here we have the loss of only a few of the sucking pigs, one shoat that was quite sick at the time of treatment, and one other shoat that probably died from some complication rather than from the cholera attack itself.

The pigs died, perhaps, because they were already badly infected at the time, and also, perhaps, the dose of serum used was a little small, considering the fact that they were already sick. Sucking pigs require a larger dose in proportion to their weight than the older animals.

Herd Number Twenty-three.—The twenty-third experimental herd reported in this series of test cases was located in the northwest quarter of Section 32, Milford Township. This herd was in an infected district, and at the time it was first visited there was a cholera herd on another farm not over 40 rods distant. This herd was first visited on October 21, 1907. At this time one shoat was off feed, but was not sufficiently sick to warrant killing for

postmortem examination. The balance of the herd had not been visibly affected at this time.

In the treatment of this herd, one old sow was given an injection of 40 c.c. of serum plus 2 c.c. of the virus blood. Thirty-eight shoats, averaging from 50 to 100 pounds, were each given 20 c.c. of serum and 2 c.c. of virulent blood. One small pig received 10 c.c. of serum alone.

Five shoats, of the same average size as the treated shoats, and the one shoat which was sick at the time, were left untreated to act as checks.

The sick shoat continued to grow worse, and was killed a few days later for postmortem examination. The findings in this examination were not those of typical hog-cholera. Most of the changes found were in the chest cavity, and resembled in many ways those of pneumonia rather than hog-cholera.

As there was no further loss among the checks or the treated animals, it would seem probable that this herd did not have cholera, and the value of the experiment in this herd was of little importance.

In connection with the injection of virulent blood in the herd it was afterward found that the blood used in this case, as well as that used in Herd Number 22, was not of a sufficient strength to produce death even in suceptible pigs when unprotected by serum. This, in large measure, destroys the value of these experiments.

Herd Number Twenty-four.—This herd was located about 30 rods from the herd just described, and was visited on the same day. It was found to consist of about 83 head. Many of these animals were suffering from some form of respiratory trouble, which was believed to be cholera. One of the sickest shoats was killed and a postmortem examination made. This examination failed, however, to show any signs of cholera. As a precautionary measure the herd was injected.

Sixty-two shoats, weighing from 40 to 90 pounds, were each treated with 20 c.c. of the serum plus 1 c.c. of virulent blood. Eight small pigs each received 20 c.c. of the serum alone. Thirteen shoats of various sizes were left as checks.

Later observations of this herd showed that neither the treated nor untreated animals became sick, and so it must be concluded

that cholera did not really exist. The condition was more likely an inflammation of the large air-tubes, such as is not uncommonly met with. This case serves to show that not every case of cough in the hog is hog-cholera.

Herd Number Twenty-five.—This herd also was located in Milford Township, and was only about 40 rods from Herd Number Twenty-three. The herd was visited and treated on the same date as Herd Number Twenty-three and Herd Number Twenty-four.

At this time the herd was apparently sick, as several of the animals had a diarrhea and were not eating well. None were sufficiently sick, however, to justify their being killed for the purpose of postmortem examination.

Seven shoats in this herd, weighing about 100 pounds each, were each injected with 20 c.c. of serum. Fourteen others, of about the same weight, including those that were sick, were left to serve as checks.

Further observation of this herd showed that neither the treated animals nor those left as checks developed hog-cholera. The sick animals apparently were not suffering from cholera, but, instead, had some digestive disturbance which was the cause of the diarrhea.

This herd is also of some value in showing that not all cases of diarrhea in the hog are due to hog-cholera. The serum has an advantage, however, in these doubtful cases, that it certainly produces no bad results. In this case the use of the serum was followed by no bad results. In case of doubt, it is always better to play on the safe side, and inject the serum rather than wait for some of the animals to die to make sure that the disease is cholera. It must be remembered, in the handling of a cholera herd, that time is of the greatest value. The sooner after the outbreak starts that serum is used in the herd, the smaller will be the losses from the disease. When serum is injected almost immediately after the first animals in the herd begin to show signs of illness it is often possible to completely check the outbreak and prevent the loss of any of the hogs in this herd.

In addition to this, if the simultaneous treatment be used in the herds on the farms immediately adjoining the infected premises, the result will be the checking of any spread of the disease, and the

injected, each receiving 20 c.c. of serum and 1 c.c. of virulent blood. Two old sows received 40 c.c. of the serum, with an accompanying dose of 2 c.c. of virulent blood.

The results in this herd were very satisfactory. The entire herd remained healthy and thrifty throughout the outbreak, and there can be no doubt that this was in large measure due to the protection given by the treatment administered.

We again have in this case an example of how readily the spread of a hog-cholera outbreak can be checked by the use of this new method of handling the disease.

Herd Number Twenty-eight.—The twenty-eighth herd in this series of experimental tests was located at a considerable distance from the last three herds mentioned. This herd was located in the southeast quarter of Section 19, Washington Township, Story County, Iowa. It was a very valuable herd, composed largely of pure-bred Duroc-Jersey hogs of different ages and sizes. This herd was first visited on October 22, 1907, and at this time the animals appeared to be in good health, with the exception of 3 shoats, which were of about 100-pound size. These animals appeared to be a little droopy, and had been so for three or four days.

On a neighboring farm, about one-quarter of a mile distant, hogs had been dying for some time from a disease which was probably cholera. As the animals in Herd Number Twenty-eight were of a pure-bred stock, the owner had been feeding them high with a view to hastening their development and growth. As a result, a majority of the animals, and especially the young gilts, were exceptionally fat. The 3 sick shoats had been running with the gilts and old sows, so that the entire herd had been more or less exposed by contact with the sick hogs. The young boars in this herd had been kept in a separate feed lot, and, consequently, had been less exposed than the other animals.

As this was a pure-bred herd, and the 3 sick shoats were of considerable value, they were not regarded as sick enough to warrant their being slaughtered for purpose of making a postmortem diagnosis. The method of treatment in this herd was as follows:

Twenty-nine spring gilts, each weighing about 200 pounds, were given 30 c.c. of serum, with an accompanying dose of 1 c.c. of the virus blood. Four smaller gilts, of about 100 pounds' weight, re-

ceived 20 c.c. each of the serum with 1 c.c. of virulent blood. Twenty-one old sows were each given 40 c.c. of serum with 1 c.c. of virus blood. Two old boars were each given 40 c.c. of the serum with 1 c.c. of virulent blood. Ten small sucking pigs were injected by the single or serum-alone method, each pig receiving 20 c.c. of the serum. Ten young boars received 20 to 30 c.c. of serum with 1 c.c. of virus. Three gilts were left untreated for the purpose of being exposed later along with some of the treated animals in case the herd proved not to have been affected with hog-cholera at the time of treatment.

This herd was next visited on October 31st, and at this time a number of the gilts, including the 3 checks, were sick. One old sow died very soon after the treatment was given, but, in the opinion of the owner, she had not shown the usual symptoms of hog-cholera. According to his statement, she swelled badly under the abdomen, and it is quite possible that she was infected with the germs of blood-poisoning at the time of injection, and died from this disease rather than from cholera.

A postmortem examination at this time was made of one of the sucking pigs, and the changes found were those of hog-cholera as usually seen. There was some redness of the skin, the glands in the flank were enlarged and reddened, the spleen was enlarged and dark in color, the liver was congested, and there were several pin-point red dots in the kidneys.

On November 7th, when the next report was received on this herd, nearly all of the sucking pigs, several of the gilts, and one young boar had died. A few others were sick at this time.

On November 24th another visit was made to this farm. At this time 2 of the gilts had just died, and a postmortem examination was made of the dead bodies. In both cases the changes reported are those usually seen in the acute type of hog-cholera—the lungs were congested and filled with blood, the spleen was enlarged and dark in color, the liver was much congested, there was a well-marked spotting of the kidneys, and many small ulcers were found in the large bowel.

Another inspection of the herd later on showed that 16 gilts, 3 old sows, 3 boars, 9 of the sucking pigs, and 2 of the checks had died. The third check had also become sick, but later recovered.

In this case the final outcome was not as favorable as we have seen in a number of the other herds where the serum or serum and virus were used. However, this can, in large measure, be explained in this herd from the fact that the disease was apparently well started in the herd before the serum was first made use of. If the injection had been given in this herd a few days earlier there might have been a much different history to record. Even as it was, the percentage of deaths was low as compared with what it would usually have been without the use of this method of treatment.

In this herd it will be noted that the disease was apparently of a quite severe type, and the animals appear to have been quite susceptible to the action of the disease. This was, no doubt, in part due to the fact that this was a pure-bred herd, and also to the fact that the gilts, in which the disease made its most severe inroads, were exceedingly fat. It will be remembered that in discussing the predisposing factors in the production of hog-cholera it was stated that pure-bred animals were usually of a more frail constitution and more susceptible to the disease. This is in large part due to the overcare which these pure-bred herds receive. The animals are simply pampered and force fed until their powers of resistance against disease are very much lowered. As a result, when cholera or any other severe disease strikes them they are in poor condition to resist, and fall easy victims to the attack.

Overfat animals also are very liable to fall early victims in an outbreak of cholera. When hogs are force fed and fattened very rapidly there is a weakening of the heart and muscles, due to an overdeposit of fat in their structure, and, as a result, the animal becomes so weakened as to be unable to fight vigorously against an attack of any disease. These are all-important elements in figuring the odds for and against recovery in a given case of cholera, and must all be taken into consideration in passing judgment upon the effects obtained by treatment by serum or any other method.

In the case of the boars of this herd, which were kept in a separate lot and were not directly exposed to contact with the sick animals, the loss was very slight. The disease did, however, apparently reach this herd, but the loss was kept down by the effects of the treatment given. The results in this herd should serve to

call our attention to the advisabillty of dividing our hogs up into small droves, rather than allowing them to all range together in the one herd. It is a little more inconvenient to handle them in two or three droves, but the advantages of this arrangement in case of an outbreak of cholera are so great that it would apparently well repay for the additional amount of care which would be necessary in handling them in the separate feed lots.

In the case of the old sow, that died apparently from an infection received during the administration of the treatment, we have impressed upon our minds the importance of the most extreme care in handling the animals at time of treatment. Serum needles and syringes must be kept absolutely clean, and every possible source of infection guarded against. Otherwise, there are bound to be losses that could probably have been prevented. An occasional accident of this nature is liable to happen even with the most careful operators, but the danger is much increased if the serum be given by an incompetent man.

Herd Number Twenty-Nine.—The twenty-ninth of these experiment herds was located in the northwest quarter of Section 2, Jackson Township, Boone County, Iowa. Boone County closely adjoins Story County, but this herd was some distance from the herds which have already been described. This drove was also a pure-bred herd, being composed of full-blood Chester-Whites of various ages and sizes.

When this herd was first visited by the Bureau of Animal Industry representatives on October 22, 1907, several of the shoats on the farm were sick. The disease had been present for some time, as the first sick hogs had been noticed several days previous. The disease made its first appearance among the gilts and barrows. There were a number of young boars in the herd, but they were kept in a separate feed lot, some distance from the balance of the herd, and were apparently well on the day of treatment.

As there was no cholera in the immediate neighborhood of this farm, it was impossible to secure any definite history as to just how the disease had reached the herd.

The animals which were sick at the time the farm was visited showed the usual symptoms of hog-cholera—they remained in their nests, did not eat, were weak in the hind legs, and had some

diarrhea. One shoat was killed for the purpose of conducting a postmortem examination and making sure of the diagnosis of cholera. The examination of the internal organs of this animal showed some signs of hog-cholera, but the findings were not just what could be called characteristic of hog-cholera. There were some red spots in the lungs, some enlargement of the spleen, and a slight congestion of the liver and kidneys. There was an absence, however, of the turkey-egg spotting of the kidneys. A few small ulcers were found in the first part of the large bowel or blind gut.

Later history of this herd shows that on October 31, 1907, a postmortem examination was made of a 100-pound shoat that had died that day. This animal also showed about the same signs of cholera as were found in the one just described. In the last-mentioned shoat the congestion of the liver was more pronounced and there were a number of well-marked ulcers in the large bowel. The outbreak was one apparently of the chronic rather than the acute type of hog-cholera.

Treatment was given in this herd on October 22d. Fifteen young boars, weighing about 100 pounds, were each treated with 20 c.c. of serum plus 1 c.c. of virulent blood. Seven yearling boars received 40 c.c. of the same serum plus 1 c.c. of the virulent blood. One yearling sow also received 40 c.c. of serum and 1 c.c. of virus blood. Thirty shoats, which varied in size and weight from 50 to 100 pounds, received 20 c.c. of the serum alone.

Five boars, 1 old sow, and 8 shoats were left untreated, to serve as checks.

The herd was again visited on October 31st for the purpose of making an inspection and noting the effect of the treatment given. At this time it was found that most of the 8 check shoats were sick, and also 2 or 3 of the treated pigs. At this time one of the shoats which had just died was opened up for purpose of diagnosis. The results of this examination have already been stated in the paragraph above. On this date there were no signs of the appearance of the disease among the boars which had been treated.

On November 7th the herd was again visited. At this time the boars were still well. A few days later the owner castrated a number of them, including both checks and treated pigs. Soon

after being castrated the disease made its appearance in the check boars and also in some of the treated animals. Eventually all the check boars died and also one of the treated boars. The old sow which was left as a check became sick, and lingered along for some time, but finally died. All of the check shoats died except one. Of the 30 shoats treated by use of the serum alone, only 4 died.

In this experiment the results are a little questionable, as the virus blood used was afterward found to have been of rather weak quality. For this reason the animals which received the double treatment in this case in reality were receiving only a single treatment, as the virus injected was comparatively worthless. As the disease did not appear among the boars until some time after treatment, it is quite possible that the protective power given by the serum had in part worn off, and this explains how these animals became sick later on. However, the results were quite satisfactory on the whole, as in the case of the untreated boars all were lost, while of the 22 treated boars only 1 died.

In this herd we have an example of the manner in which danger is increased by performing any surgical operation after administration of serum. Even though in this instance the castration was not done until two weeks later, it undoubtedly had an important part in the lowering of the vitality of the young boars to the point where they became susceptible to the disease. No ringing, castrating, or other surgical work should be done in the herd during the time when there is danger of an outbreak of cholera. It is a good plan to wait at least three or four weeks after the use of the double treatment before doing any of these surgical procedures.

We have in this herd also an example of the importance of using a tested virus as well as a tested serum in giving the double treatment. The results from the simultaneous treatment are bound to be disappointing unless care is taken to see that the virus used, as well as the serum injected, is of proper quality. If the virus be worthless, then the treatment is simply a serum-alone treatment, and the protection against hog-cholera will only last for a short time—about three to six weeks. It must be remembered that it is the virulent blood in this double treatment that causes

the cells of the animal body to take up the work of forming germ-fighting bodies, and if the virus is not strong and active there will be no results from its use.

In many cases where the manufacturer of a serum is not certain as to the protective power of his product against real virulent blood, "virus blood" has been supplied which was not virulent blood at all. As a result, the effects produced were not what had been expected or desired. It is in such cases as these that serum-simultaneous treatment has been followed by an outbreak of cholera several weeks later. In many cases this has been blamed upon infection of the premises by virulent blood, when, as an actual matter of fact, the trouble lies in the absence of any genuine virus in the virulent blood used. To have success with the simultaneous method of treatment it is equally necessary that we use a tested virus blood as well as a tested protective serum. It is the combination of these two that produces the reaction on the part of the tissues which gives to the animal the power of lifelong protection against hog-cholera.

It is worthy of note in this herd that the old sow put up a very long fight against the disease. This is usually the case, and very often these old sows are able to fight off the effects of the disease and come through with a permanent immunity to further attacks. As a rule, the older the animal, the better are its chances for recovery.

Herd Number Thirty.—This herd was located within a quarter of a mile of Herd Number 10, previously described, and was treated on October 23, 1907, for the purpose of preventing spread of the disease from the infected farm on which Number 10 Herd was located. At the time of giving the treatment the animals were all apparently in good health, and the entire herd was treated.

Thirty-seven shoats, averaging in weight from 50 to 125 pounds, were given from 20 to 25 c.c. of serum with 2 c.c. of blood taken from diseased animals. One old sow received 40 c.c. of the serum alone.

The blood used in this herd for virus purposes was afterward tested at the station and did not prove very virulent. It was perhaps sufficiently active to keep up stimulation of the cells of the body long enough to cause development of antibodies. In

any case, the results obtained were good. The herd passed through the balance of the fall and winter without any signs of sickness, and protection from the disease was apparently complete.

Here, again, we have an example of the undesirability of using an untested virulent blood. The blood used in this herd was not tested out until after it had been injected. As it proved to be rather weak, it is almost impossible to say whether these animals really received the benefits of a single or double method of treatment. It would seem more likely, however, that the virus was sufficiently active to cause formation of germ-destroying bodies, as the protection lasted throughout the balance of the season.

Herd number thirty-one of the experimental series was located in the northwest quarter of Section 22, Grant Township, Story County, Iowa. This farm was right in the center of a widely infected district, and was surrounded on all sides by cholera herds. At the time the herd was visited the animals had been in considerable danger for some time, on account of the close proximity of cholera-infected droves. Treatment was given on October 23, 1907. At this time all of the hogs seemed well with the exception of one old sow. The principal symptom in this old sow was a marked diarrhea, which the owner believed to be due to the fact that she had been fed with pumpkins.

Twenty-five shoats, weighing from 60 to 100 pounds, were each given 20 c.c. of the serum plus 2 c.c. of blood from a diseased animal. Seven old hogs, weighing from 250 to 350 pounds, were given 40 c.c. each of the serum and 2 c.c. of the virulent blood. Twelve sucking pigs received 10 c.c. each of the serum alone. Four shoats of various sizes, 1 old sow, and 4 sucking pigs from the same litter as those treated were left untreated to serve as checks.

After-results in this herd showed that the old sow, which was left as a check, died two days after the herd was treated. One of the treated shoats also died four days after injection. On November 1st 3 of the checks and 1 treated shoat were sick. Later the treated shoat and 2 of the check shoats died. A final report on this herd showed that of the 4 check shoats, 2 died and the other 2 became sick, but afterward recovered. The 4 sucklings which were left as checks all died, while all

In this case the final outcome was not as favorable as we have seen in a number of the other herds where the serum or serum and virus were used. However, this can, in large measure, be explained in this herd from the fact that the disease was apparently well started in the herd before the serum was first made use of. If the injection had been given in this herd a few days earlier there might have been a much different history to record. Even as it was, the percentage of deaths was low as compared with what it would usually have been without the use of this method of treatment.

In this herd it will be noted that the disease was apparently of a quite severe type, and the animals appear to have been quite susceptible to the action of the disease. This was, no doubt, in part due to the fact that this was a pure-bred herd, and also to the fact that the gilts, in which the disease made its most severe inroads, were exceedingly fat. It will be remembered that in discussing the predisposing factors in the production of hog-cholera it was stated that pure-bred animals were usually of a more frail constitution and more susceptible to the disease. This is in large part due to the overcare which these pure-bred herds receive. The animals are simply pampered and force fed until their powers of resistance against disease are very much lowered. As a result, when cholera or any other severe disease strikes them they are in poor condition to resist, and fall easy victims to the attack.

Overfat animals also are very liable to fall early victims in an outbreak of cholera. When hogs are force fed and fattened very rapidly there is a weakening of the heart and muscles, due to an overdeposit of fat in their structure, and, as a result, the animal becomes so weakened as to be unable to fight vigorously against an attack of any disease. These are all-important elements in figuring the odds for and against recovery in a given case of cholera, and must all be taken into consideration in passing judgment upon the effects obtained by treatment by serum or any other method.

In the case of the boars of this herd, which were kept in a separate lot and were not directly exposed to contact with the sick animals, the loss was very slight. The disease did, however, apparently reach this herd, but the loss was kept down by the effects of the treatment given. The results in this herd should serve to

call our attention to the advisabillty of dividing our hogs up into small droves, rather than allowing them to all range together in the one herd. It is a little more inconvenient to handle them in two or three droves, but the advantages of this arrangement in case of an outbreak of cholera are so great that it would apparently well repay for the additional amount of care which would be necessary in handling them in the separate feed lots.

In the case of the old sow, that died apparently from an infection received during the administration of the treatment, we have impressed upon our minds the importance of the most extreme care in handling the animals at time of treatment. Serum needles and syringes must be kept absolutely clean, and every possible source of infection guarded against. Otherwise, there are bound to be losses that could probably have been prevented. An occasional accident of this nature is liable to happen even with the most careful operators, but the danger is much increased if the serum be given by an incompetent man.

Herd Number Twenty-Nine.—The twenty-ninth of these experiment herds was located in the northwest quarter of Section 2, Jackson Township, Boone County, Iowa. Boone County closely adjoins Story County, but this herd was some distance from the herds which have already been described. This drove was also a pure-bred herd, being composed of full-blood Chester-Whites of various ages and sizes.

When this herd was first visited by the Bureau of Animal Industry representatives on October 22, 1907, several of the shoats on the farm were sick. The disease had been present for some time, as the first sick hogs had been noticed several days previous. The disease made its first appearance among the gilts and barrows. There were a number of young boars in the herd, but they were kept in a separate feed lot, some distance from the balance of the herd, and were apparently well on the day of treatment.

As there was no cholera in the immediate neighborhood of this farm, it was impossible to secure any definite history as to just how the disease had reached the herd.

The animals which were sick at the time the farm was visited showed the usual symptoms of hog-cholera—they remained in their nests, did not eat, were weak in the hind legs, and had some

diarrhea. One shoat was killed for the purpose of conducting a postmortem examination and making sure of the diagnosis of cholera. The examination of the internal organs of this animal showed some signs of hog-cholera, but the findings were not just what could be called characteristic of hog-cholera. There were some red spots in the lungs, some enlargement of the spleen, and a slight congestion of the liver and kidneys. There was an absence, however, of the turkey-egg spotting of the kidneys. A few small ulcers were found in the first part of the large bowel or blind gut.

Later history of this herd shows that on October 31, 1907, a postmortem examination was made of a 100-pound shoat that had died that day. This animal also showed about the same signs of cholera as were found in the one just described. In the last-mentioned shoat the congestion of the liver was more pronounced and there were a number of well-marked ulcers in the large bowel. The outbreak was one apparently of the chronic rather than the acute type of hog-cholera.

Treatment was given in this herd on October 22d. Fifteen young boars, weighing about 100 pounds, were each treated with 20 c.c. of serum plus 1 c.c. of virulent blood. Seven yearling boars received 40 c.c. of the same serum plus 1 c.c. of the virulent blood. One yearling sow also received 40 c.c. of serum and 1 c.c. of virus blood. Thirty shoats, which varied in size and weight from 50 to 100 pounds, received 20 c.c. of the serum alone.

Five boars, 1 old sow, and 8 shoats were left untreated, to serve as checks.

The herd was again visited on October 31st for the purpose of making an inspection and noting the effect of the treatment given. At this time it was found that most of the 8 check shoats were sick, and also 2 or 3 of the treated pigs. At this time one of the shoats which had just died was opened up for purpose of diagnosis. The results of this examination have already been stated in the paragraph above. On this date there were no signs of the appearance of the disease among the boars which had been treated.

On November 7th the herd was again visited. At this time the boars were still well. A few days later the owner castrated a number of them, including both checks and treated pigs. Soon

after being castrated the disease made its appearance in the check boars and also in some of the treated animals. Eventually all the check boars died and also one of the treated boars. The old sow which was left as a check became sick, and lingered along for some time, but finally died. All of the check shoats died except one. Of the 30 shoats treated by use of the serum alone, only 4 died.

In this experiment the results are a little questionable, as the virus blood used was afterward found to have been of rather weak quality. For this reason the animals which received the double treatment in this case in reality were receiving only a single treatment, as the virus injected was comparatively worthless. As the disease did not appear among the boars until some time after treatment, it is quite possible that the protective power given by the serum had in part worn off, and this explains how these animals became sick later on. However, the results were quite satisfactory on the whole, as in the case of the untreated boars all were lost, while of the 22 treated boars only 1 died.

In this herd we have an example of the manner in which danger is increased by performing any surgical operation after administration of serum. Even though in this instance the castration was not done until two weeks later, it undoubtedly had an important part in the lowering of the vitality of the young boars to the point where they became susceptible to the disease. No ringing, castrating, or other surgical work should be done in the herd during the time when there is danger of an outbreak of cholera. It is a good plan to wait at least three or four weeks after the use of the double treatment before doing any of these surgical procedures.

We have in this herd also an example of the importance of using a tested virus as well as a tested serum in giving the double treatment. The results from the simultaneous treatment are bound to be disappointing unless care is taken to see that the virus used, as well as the serum injected, is of proper quality. If the virus be worthless, then the treatment is simply a serum-alone treatment, and the protection against hog-cholera will only last for a short time—about three to six weeks. It must be remembered that it is the virulent blood in this double treatment that causes

the cells of the animal body to take up the work of forming germ-fighting bodies, and if the virus is not strong and active there will be no results from its use.

In many cases where the manufacturer of a serum is not certain as to the protective power of his product against real virulent blood, "virus blood" has been supplied which was not virulent blood at all. As a result, the effects produced were not what had been expected or desired. It is in such cases as these that serum-simultaneous treatment has been followed by an outbreak of cholera several weeks later. In many cases this has been blamed upon infection of the premises by virulent blood, when, as an actual matter of fact, the trouble lies in the absence of any genuine virus in the virulent blood used. To have success with the simultaneous method of treatment it is equally necessary that we use a tested virus blood as well as a tested protective serum. It is the combination of these two that produces the reaction on the part of the tissues which gives to the animal the power of lifelong protection against hog-cholera.

It is worthy of note in this herd that the old sow put up a very long fight against the disease. This is usually the case, and very often these old sows are able to fight off the effects of the disease and come through with a permanent immunity to further attacks. As a rule, the older the animal, the better are its chances for recovery.

Herd Number Thirty.—This herd was located within a quarter of a mile of Herd Number 10, previously described, and was treated on October 23, 1907, for the purpose of preventing spread of the disease from the infected farm on which Number 10 Herd was located. At the time of giving the treatment the animals were all apparently in good health, and the entire herd was treated.

Thirty-seven shoats, averaging in weight from 50 to 125 pounds, were given from 20 to 25 c.c. of serum with 2 c.c. of blood taken from diseased animals. One old sow received 40 c.c. of the serum alone.

The blood used in this herd for virus purposes was afterward tested at the station and did not prove very virulent. It was perhaps sufficiently active to keep up stimulation of the cells of the body long enough to cause development of antibodies. In

any case, the results obtained were good. The herd passed through the balance of the fall and winter without any signs of sickness, and protection from the disease was apparently complete.

Here, again, we have an example of the undesirability of using an untested virulent blood. The blood used in this herd was not tested out until after it had been injected. As it proved to be rather weak, it is almost impossible to say whether these animals really received the benefits of a single or double method of treatment. It would seem more likely, however, that the virus was sufficiently active to cause formation of germ-destroying bodies, as the protection lasted throughout the balance of the season.

Herd number thirty-one of the experimental series was located in the northwest quarter of Section 22, Grant Township, Story County, Iowa. This farm was right in the center of a widely infected district, and was surrounded on all sides by cholera herds. At the time the herd was visited the animals had been in considerable danger for some time, on account of the close proximity of cholera-infected droves. Treatment was given on October 23, 1907. At this time all of the hogs seemed well with the exception of one old sow. The principal symptom in this old sow was a marked diarrhea, which the owner believed to be due to the fact that she had been fed with pumpkins.

Twenty-five shoats, weighing from 60 to 100 pounds, were each given 20 c.c. of the serum plus 2 c.c. of blood from a diseased animal. Seven old hogs, weighing from 250 to 350 pounds, were given 40 c.c. each of the serum and 2 c.c. of the virulent blood. Twelve sucking pigs received 10 c.c. each of the serum alone. Four shoats of various sizes, 1 old sow, and 4 sucking pigs from the same litter as those treated were left untreated to serve as checks.

After-results in this herd showed that the old sow, which was left as a check, died two days after the herd was treated. One of the treated shoats also died four days after injection. On November 1st 3 of the checks and 1 treated shoat were sick. Later the treated shoat and 2 of the check shoats died. A final report on this herd showed that of the 4 check shoats, 2 died and the other 2 became sick, but afterward recovered. The 4 sucklings which were left as checks all died, while all

of the treated sucking pigs lived. The old sow that was left untreated to serve as a check died, as above noted, while all of the old hogs which were treated survived. Of the 25 treated shoats, only 2 were lost, the remaining 23 showing no indications of disease.

The history of this herd is a good example of what may be accomplished at the beginning of a hog-cholera outbreak. The herd described in this case had already been exposed, and the animals were just beginning to come down with the disease. The hog that was supposed to be sick from eating pumpkins was, in reality, no doubt suffering from cholera at the time. The disease was in course of development in the other animals, and, had the serum treatment been delayed for a few days longer, no doubt the most of the herd would have been lost.

The time to get good results from the use of the serum treatment is right at the start of the disease. After the disease has gained a good headway, and several animals are just about ready to die, is no time to start out looking for serum. If the single treatment is to be used it must be used early, even while the disease is still in the incubation period. The better method, of course, is to give the double treatment several weeks or even months before the disease gets into the herd.

While the results from the use of the serum have been good in these reported herds, I do not believe that they are as good as we can now hope for. In the first place, the amount of serum given in these cases has been very small—much smaller than is now being used and recommended by the United States Bureau of Animal Industry and the various state experiment stations. Especially should a larger dose of serum be used if the animal shows visible symptoms of being sick, or if he shows, by the presence of a high fever, that the disease is coming on. There is no record shown in these herds that temperatures were taken, and if they were, no attention was apparently given to them in adjusting the dose of the serum. It must be remembered, however, that these test-herds were among the early experiments with the serum, and much advance has since been made. Reports of experiments now being conducted will no doubt prove even much more favorable.

The 2 treated shoats which died were no doubt already coming down with the disease at the time that the treatment was given, and, to have any beneficial effects in their case, it would have been necessary to use a much larger dose of serum than was here used.

Herd Number Thirty-two.—This herd was located in the southeast quarter of Section 18, Grant Township, Story County. It was first seen and treated on October 24, 1907. These hogs had already been exposed to hog-cholera, and some of the animals were at this time showing signs of illness. Two of the shoats exhibited well-marked symptoms of hog-cholera—loss of appetite, remained in their nests, appeared droopy, and were weak in the hind extremities. The balance of the herd still appeared to be well.

Fourteen shoats, which were of an average weight of about 150 pounds each, received 30 c.c. of the serum plus 2 c.c. of the virulent blood. Eight shoats of the same weight were each given 20 c.c. of serum and 2 c.c. of the virus blood. Twenty-one shoats, including the 2 sick ones, ranging in weight from 40 to 100 pounds each, received 20 c.c. of the serum plus 2 c.c. of the blood. Nine shoats, which were slightly smaller in size, each received 20 c.c. of the serum with 1 c.c. of the virus blood. One old sow weighing 250 pounds was given 40 c.c. of the serum and 2 c.c. of virulent blood.

Fourteen shoats, which averaged from 40 to 150 pounds, were left untreated to remain as checks.

When seen on November 5th the 2 pigs that were sick when treated had died. The other treated pigs were all apparently well. One of the check animals had died and 12 others were sick. The checks continued to die, until 11 of the 14 were lost. One of the 3 which survived was rendered worthless by the disease and became a chronic runt. The other 2 recovered and were in fairly good condition.

The result on this farm was very pleasing. The outbreak in the herd was genuine cholera, and was of a fairly severe type, as evidenced by the death of all the check animals except 3. There can be no question as to the beneficial results obtained in this herd from the serum treatment. Not one of the treated animals was

lost except the 2 that were already sick at the time treatment was given. The method of treatment used in these 2 sick animals is hardly that which would be used at the present time. If instead of a dose of serum and virus these 2 animals had received a double dose of serum alone their chances for recovery would have been better.

The double treatment is now regarded as a treatment to be used only in animals that are healthy at the time of treatment. The best method of judging this is by the use of the thermometer. A hog may be sick with cholera and yet show no signs of it on careful examination. If the temperature is taken, it will often be found to be high for two or three days before the animal shows the loss of appetite, droopiness, and muscular weakness which make the picture of fully developed cholera as seen in the feed lots of the hog-producing belt.

Always have temperatures taken in administering hog-cholera serum treatment. If the animal shows a normal temperature, the double method of injection should be used, giving both serum and virus. If the temperature is elevated, the single or serum-alone treatment is indicated. It is a good plan to increase the dose in these cases that show a temperature, and, instead of the equal amount of serum for an animal of this weight, give double the amount. This method, if carefully followed, will result in a much increased percentage of recoveries as a result of serum treatment.

Herd Number Thirty-three.—This herd also was located in the infected territory in which Herd Number Ten was situated. This thirty-third of the experimental herds was located about a quarter of a mile from Herd Number Ten. The herd was well at the time the treatment was given. The entire herd was treated in order to check if possible the spread of the disease from the infected herd on Farm Number Ten.

Seven spring shoats, of an average weight of about 200 pounds each, received 40 c.c. of serum. Six shoats of 120 pounds, weight were each given 30 c.c. of the serum. The object of this experiment was apparently to test the power of the serum-alone treatment in the prevention of cholera.

The results obtained were very satisfactory. None of the

protected animals became sick. This is a good example of what can be done in preventing spread of the disease even with the single method of injection. Personally, I am more favorable to the use of the double method of treatment in cases of this kind. However, where for any reason there is a prejudice against the double method, the single treatment may be used with excellent results in preventing the immediate danger.

The main disadvantage of the double treatment lies in the fact that the protection given is only temporary in nature, and three to six weeks later the animals are again unprotected, and must be again treated or they will contract the disease if exposure again occurs.

Herd Number Thirty-four.—The thirty-fourth herd of this series was also an exposed one, located in the neighborhood of Herd Number Ten, and was treated for the purpose of preventing the spread of the disease to neighboring farms from this infected premises. This herd was treated on October 27th, and, as the object was to prevent spread of the disease, all the animals on the place were treated.

Thirty-two shoats, weighing from 60 to 100 pounds each, received 20 c.c. of serum, and 8 old hogs, weighing from 350 to 450 pounds each, received 40 c.c. of the same serum.

In this case also the results were all that could be hoped for. The entire herd remained well, and the spread of the disease in this direction was checked. We have had in these herds immediately surrounding infected Herd Number Ten an excellent example of what may be accomplished by prompt action in an infected neighborhood. By getting right into the neighborhood at the commencement of the outbreak the United States Government experts were in this case able to limit the disease almost to this one farm, and equally good results can be obtained by other competent men in other parts of the country if action be taken immediately there is an outbreak started and a good grade of serum used.

Herd Number Thirty-five.—The thirty-fifth herd of this series was located in the northeast quarter of Section 34, Jackson Township. It was first visited on November 6, 1907, in response to a very urgent request from the owner. The herd consisted of pure-bred Duroc-Jersey swine of different ages.

At the time the herd was visited by the bureau representatives one shoat had already died, and several others were showing characteristic symptoms of hog-cholera. As the animals were all very valuable, none of them were killed for the purpose of making a post-mortem diagnosis. The supply of serum on hand at this time was very small and it was necessary to leave a considerable number of the animals untreated as checks. These checks were mostly barrows and smaller gilts.

Treatment in this herd was carried out as follows: A boar, weighing about 200 pounds, and which was already showing symptoms of hog-cholera, was given 70 c.c. of serum alone. Two boars, weighing about 140 pounds each, both of which also showed symptoms of the disease, were given 40 c.c. each of the same serum. Eleven boars, weighing from 100 to 200 pounds each, all probably more or less affected, were given 30 c.c. each of the serum. Two shoats, probably also infected, received 40 c.c. each of serum. Three shoats, of an average weight of about 50 pounds, were given 20 c.c. of serum. Thirty-three shoats of different weights were given 30 c.c. each of serum.

One old sow with a litter of young pigs was given 40 c.c. of serum. Four of her pigs received 20 c.c. each of the same serum, while 3 other pigs of the same litter were left untreated as checks. There was another old sow with a litter of pigs on the farm. Seven of these pigs were treated with 20 c.c. each of serum. The sow herself and the balance of her litter were left untreated as checks. Both of these litters were about two months old. Five old sows received 50 c.c. of serum alone.

Twenty-seven shoats of various sizes were left untreated to serve as checks. The large number of untreated checks left in this case has already been explained as due to the fact that the supply of serum on hand at that time was limited.

The reports of the results from the treatment of this herd is quite interesting. Of the 14 boars that were treated, only 2 died. It will be remembered that 3 of these animals showed symptoms of the disease at time of treatment, and the other 11 had been exposed for several days and were no doubt affected. The one old boar that received the 70 c.c. of serum showed improvement for a few days and then became worse, finally dying. It would seem

probable that a second injection with serum might have saved this animal. Several of the treated boars showed slight symptoms of the disease even after treatment, but they finally mastered the disease and recovered.

Of the 38 treated shoats, only 3 died. It will be recalled that 2 of these showed signs of probable infection at the time of treatment. The old sow which served as a check became sick and died. The other old sows which were treated remained well. All of the treated sucking pigs in both litters remained well, while all of the checks in both litters died. This was, indeed, a remarkable showing, and one which in itself should convince even the most doubtful that there is, indeed, something in the serum treatment.

Of the 27 untreated shoats left as checks, all died but 5. Here, again, we have a most striking example of what will happen even in a well-cared-for herd without the use of the serum treatment.

It will be noted in this herd that the results accomplished were quite a bit better than in some of the other herds treated under somewhat similar conditions. The explanation of this is in part to be found, I think, in the fact that larger doses of serum were used in this herd than have been reported in the preceding herds. Serum, while a great agent, must be given in large enough dosage to combat the infection present. This is especially the case where a herd is being treated that is already infected.

It will be noted in this last herd that the dose of serum used in the sucking pigs was 20 c.c. instead of the dose of 10 c.c. which had been used in a number of the other sucking pigs treated. The brilliancy of the results in this last herd speaks most eloquently for the use of the larger dose of serum.

It must be remembered that in these young pigs a comparatively larger dose of serum is required than in the larger animals. It is a question in my mind whether a dose of less than 15 c.c. of serum should ever be given. Especially I do not believe that less that 15 c.c. of serum should be administered if there is presence of infection in the herd. The resisting power of the body of these little fellows is very weak, and what protection they get is received almost entirely from the serum injected. In the older animals there is a considerable amount of natural resistance on the part of the tissues of the body, and this allows us to use a somewhat

smaller amount of serum in comparison to size than is used in the smaller pigs.

The results in this herd also offer conclusive proof of the fact that it is not too late to accomplish a great amount of good with the serum treatment even after the disease has made its appearance in a herd. Use of the serum should be advised even in infected herds unless the animals are so far advanced in the disease as to be plainly hopeless. Even in the cases that are well advanced surprising results are now being reported by the use of large doses of serum. In the case of valuable pure-bred animals there should be no hesitancy in making use of the chance that offers.

While working in Pettis County, Missouri, in the summer of 1913 I injected, in company with other Bureau of Animal Industry veterinarians, a sow and litter of pigs that were well advanced with the disease. The sow was very sick, refused all food, and was scarcely able to stand. The pigs were also markedly affected, and all showed a high temperature at time of injection. In this case large doses of serum alone were used. Each of the little fellows, weighing about 20 pounds each, received an injection of 30 c.c. of serum, while the old sow received 100 c.c.

As the temperatures in these animals were very high, little or no hope was expressed for a favorable outcome, the use of the serum in this case being purely an experiment. The results obtained, however, were most surprising. Only one of the pigs died after receiving treatment. The old sow and the balance of the litter made a brilliant recovery, and were unquestionably saved by the large doses of serum that they had received.

Herd Number Thirty-six.—This herd was located in the northeast quarter of Section 8, Grant Township, and when first seen on November 8, 1907, was thought to be infected with hog-cholera. One old sow in the herd showed symptoms resembling those of cholera at the time the first inspection was made. As it was regarded as probable that the disease already existed in the herd, serum alone was used.

Four old sows were each given 40 c.c. of the serum. Seven young boars, each weighing about 150 pounds, were injected with 20 c.c. each of serum, and 3 shoats of larger size were given 30 c.c. each. The old sow which was sick and a number of shoats of

various sizes were left untreated to serve as checks. The old sow finally recovered, and, as there was no further sickness either among the treated or untreated animals, it must be concluded that hog-cholera did not really exist in the herd.

This is another example of the fact that not every disease of hogs showing loss of appetite, droopiness, and cough or diarrhea is hog-cholera. It may be stated, however, that in over 90 per cent. of such cases hog-cholera will be found to be the correct diagnosis, and so seldom is any other disease present that it is the part of wisdom to administer the serum at once, without waiting for an animal to die in order to make sure of the diagnosis. If the disease is not cholera, no damage will be done by giving the serum, and if cholera is really present every hour that the administration of serum is delayed just means that much of an increase in the number of animals that cannot be saved.

There is a little subsequent history attached to this last-mentioned herd that is of particular interest. The owner of these animals sold them at public sale the following spring, and some of them were purchased by a man who had had hog-cholera on his farm. These animals were taken home and placed in the infected feed lots, where they very promptly contracted hog-cholera and died.

This gives us again an example of the fact that the protection given by the administration of the serum alone is only temporary. It is only when the virus is used, or when it is already present in the animal at time of injection, that a permanent immunity is obtained. The great advantage of the double method of treatment lies in this very fact, that the animals after treatment can be removed to another farm where hog-cholera is present, or has been present, and can be placed in the disease-infected feed lots without danger. If they have been double treated with a virulent virus blood there is no danger, as the protection derived from this treatment lasts as long as the animals live. On the other hand, where single treatment is used, and months afterward the animals are moved to an infected feed lot, sickness and death are sure to follow.

Herd Number Thirty-seven.—The thirty-seventh herd treated in the series was located in Section 21, Washington Township.

This herd was within a half mile of an infected farm, but all the animals were apparently well when first seen. The date of treatment on this farm was November 7, 1907. The herd was made up of pure-bred Berkshires of various ages and sizes.

In this herd 12 shoats, which averaged in weight from 125 to 200 pounds, were each given 30 c.c. of serum with an accompanying dose of 1 c.c. of virulent blood. One shoat, weighing 100 pounds, was given 20 c.c. of serum with 1 c.c. of virulent blood. Three fall pigs, each weighing about 25 pounds, were given 20 c.c. each of serum alone. Five small sucking pigs received 10 c.c. each of serum alone. One old boar was given 60 c.c. of serum plus 1 c.c. of virulent blood. Two old sows received 50 c.c. of serum plus 1 c.c. of virulent blood. Another group of 4 old sows received 40 c.c. each of serum and 1 c.c. of virulent blood.

Two shoats, weighing about 150 pounds each, were left untreated to serve as checks. It was the intention to later on expose these checks, with part of the treated animals, on some nearby infected farm. Owing to the lateness of the season and large amount of other work to be done by the limited force then attached to the Bureau Station at Ames it was impossible to carry out this last part of the experiment.

The later history of this herd shows that neither the untreated checks nor the treated animals became sick. From this report it must be concluded that cholera infection did not reach this particular farm from the adjoining sick herds. The experiment, however, is of interest, in that it gives another illustration of the use of the double treatment in part of a herd without producing any bad effects in the treated or untreated swine. The animals that received the dose of 1 c.c. of virulent blood, in connection with a proper dose of protective serum, showed no ill effects from their treatment. Not only this, but they were left in the feed lot with single-treated and untreated animals without producing any cholera in them. This again offers proof of the fact that the use of the simultaneous or double method is safe. With a proper dose of a tested serum there should be no bad effects in the herds that receive the double injection. These same hogs may be left in the feed lots with unprotected animals without any danger of infection from this source. Of course, infection may reach the feed

lot from other sources, in which cases the unprotected animals would naturally fall victims.

These experiments seem to offer a suggestion, at least, that the virus which is injected into the body of the hog in giving the simultaneous treatment must be so acted upon by the tissue cells of the injected animal and the protective bodies of the serum as to neutralize entirely its disease-producing qualities. As a result, when it leaves the body of the hog so treated it is no longer a disease-producing virus, but is, instead, a neutral substance, entirely incapable of producing harm. It has worn out its disease-producing powers in the battle against the cells of the animal it sought to attack and is now harmless.

It is possible that in some herds hogs are found that are more susceptible to the effects of the cholera germ, and who may suffer mild symptoms of hog-cholera even when given an average protective dose of serum in connection with the virus. These animals are so easily influenced by cholera virus that they need more than the ordinary amount of protection. These same cases of mild cholera may discharge disease-producing germs in their urine and feces, and might infect a feed lot so as to cause an outbreak of cholera in unprotected animals. Such cases are very infrequent, and especially so if a liberal dose of a powerful serum is used.

Herd Number Thirty-eight.—This herd was located in the southwest quarter of Section 26, Franklin Township. The animals of this herd were all pure-bred Duroc-Jerseys, and consisted of old hogs and spring shoats of various sizes. When treated the animals were all in apparently good health. Treatment was given on November 9, 1907.

There were 31 spring gilts in this herd, weighing on an average from 100 to 200 pounds. These each received from 30 to 40 c.c. of serum, in accordance with their weight, and an accompanying injection of 1 c.c. of virulent blood. Sixteen young boars from the same litters, and weighing about the same as the gilts just mentioned, were treated with the same size dose of serum and a 1-c.c. injection of virus. One old boar was injected with 50 c.c. of serum and a 1-c.c. dose of virus blood. Sixteen old sows, weighing from 300 to 400 pounds each, were injected with 50 c.c. of serum and 1

pens, but not a single instance was reported in which any of them afterward became sick.

This is one of the most interesting experiments reported, and the lessons to be learned from it are many:

In the first place, it shows again conclusively that 1 c.c. of virulent blood can be injected into the body of a susceptible animal without any danger, if accompanied by a proper dose of a potent serum. There is absolutely no danger of producing cholera in this manner if the serum used has been properly checked against the virus and proved to have protective power sufficient to neutralize the disease-producing bodies in the virus.

Second, it is shown in this experiment that when the treated animals were placed in the same feed lots and ranges with 15 untreated shoats there was no development of the disease in these animals. The period of four weeks which passed between injection of the treated animals and the development of the first signs of sickness in the check shoat is entirely too long for the average case of cholera. It can be said, with extreme positiveness, that this outbreak in the check shoats did not appear as a result of association with the treated animals.

Very interesting, indeed, is the third point in this instructive experiment: The young boar that had apparently entirely recovered from a mild attack of cholera proves capable of infecting the new herd into which he is introduced. This again serves to illustrate the fact that animals that have even apparently recovered from cholera are unsafe to add to a susceptible herd, unless that herd be first protected by serum or serum-simultaneous treatment. It seems that the hog which passes through what appears to be a mild attack of the disease is even more dangerous than the one that has the disease in the more severe form. The incubation period of eight days which passed between the purchase of this boar and the first signs of sickness in the checks more closely corresponds to the average incubation period of hog-cholera, and there can be but little doubt that this is the source of the infection in this herd.

The results in the treated animals, in the face of an outbreak of the disease, is a fourth point of extreme interest to be derived from the experiment in this herd. With an unquestionable out-

c.c. of virulent blood. Thirteen spring barrows were left untreated to serve as checks.

The final outcome of the experiment in this herd is, indeed, most interesting. The treated gilts and the untreated barrows remained in the same feed lot for nearly a month, and none of them showed any signs of disease. The last week in November the owner of the herd purchased a young boar from the farm on which Herd Number Thirty-five of this series was located. This boar had passed through a mild attack of cholera, but was apparently entirely well. He was carefully dipped in a disinfectant solution and placed in a pen immediately adjoining the untreated checks. Eight days after his arrival on the premises one of the check shoats was sick. This animal showed the usual symptoms of an attack of cholera—loss of appetite, dulness, inactivity, muscular weakness, and staggering gait. On December 7th this sick shoat died and the body was opened up to make sure of the cause of death. The findings were those commonly met with in hog-cholera. The spleen was swollen and dark in color, the liver was congested and enlarged, the kidneys swollen, softened, and spotted with the typical dark-red dots. In a few days 2 more of the checks were noted to be off feed, and the owner, fearing that he would lose the entire bunch of barrows, sold the remaining healthy 10 for immediate slaughter. The 2 that were sick at this time soon died.

During the entire time the 35 treated shoats were right in the same pen with the sick animals, and not one of them showed the least evidence of being sick. There can be no question but what they were repeatedly exposed to the infectious discharges from the sick shoats that died, but the protection given by the double treatment was so complete as to entirely safeguard them.

On December 4th, of this same year, the owner of the herd held a public sale, at which he disposed of a number of these treated animals. He advertised them as "vaccinated" hogs, and on the day of sale they were guaranteed against taking hog-cholera for a period of two months after removal from the premises. Many of these treated hogs were purchased by farmers whose herds had been entirely cleaned out by cholera during the past fall. They were taken to these infected farms and placed in the disease-bearing

pens, but not a single instance was reported in which any of them afterward became sick.

This is one of the most interesting experiments reported, and the lessons to be learned from it are many:

In the first place, it shows again conclusively that 1 c.c. of virulent blood can be injected into the body of a susceptible animal without any danger, if accompanied by a proper dose of a potent serum. There is absolutely no danger of producing cholera in this manner if the serum used has been properly checked against the virus and proved to have protective power sufficient to neutralize the disease-producing bodies in the virus.

Second, it is shown in this experiment that when the treated animals were placed in the same feed lots and ranges with 15 untreated shoats there was no development of the disease in these animals. The period of four weeks which passed between injection of the treated animals and the development of the first signs of sickness in the check shoat is entirely too long for the average case of cholera. It can be said, with extreme positiveness, that this outbreak in the check shoats did not appear as a result of association with the treated animals.

Very interesting, indeed, is the third point in this instructive experiment: The young boar that had apparently entirely recovered from a mild attack of cholera proves capable of infecting the new herd into which he is introduced. This again serves to illustrate the fact that animals that have even apparently recovered from cholera are unsafe to add to a susceptible herd, unless that herd be first protected by serum or serum-simultaneous treatment. It seems that the hog which passes through what appears to be a mild attack of the disease is even more dangerous than the one that has the disease in the more severe form. The incubation period of eight days which passed between the purchase of this boar and the first signs of sickness in the checks more closely corresponds to the average incubation period of hog-cholera, and there can be but little doubt that this is the source of the infection in this herd.

The results in the treated animals, in the face of an outbreak of the disease, is a fourth point of extreme interest to be derived from the experiment in this herd. With an unquestionable out-

break of hog-cholera in the check shoats kept in the same pen with them, those treated hogs remained well, and not even one of them was found to be off feed at any time. The outbreak in the checks did not occur until over a month after treatment was given. This serves to show that the protection given by the simultaneous method lasts for a long period, and is not merely a temporary one, as in the case of the single treatment. Had these shoats been given the serum-alone method it is quite likely that the protection would have run out in several of them by this time, and the disease would have in this event made its appearance in the treated as well as the untreated portion of the herd.

Any further proof that might be lacking as to the efficiency of the simultaneous injection in this case is given by the after-results, when hogs from this farm were purchased at public sale and taken to other infected feed lots and put in pens where hogs had recently died with cholera, and in some cases, no doubt, with animals that were at the time suffering from the disease. In not one of these cases did the treatment prove ineffective! Not one of the hogs so exposed took the disease! This, even though over two months had elapsed since the injections were made. More convincing proof could hardly be offered than that shown in this case. The simultaneous treatment produced absolutely no ill effects in this herd, and it conferred upon the treated shoats a complete and permanent protection against the germs of hog-cholera.

Equally good results can and will be obtained in other herds when a pure virus and a tested serum are used. The underlying basis of the treatment is sound. Its principles have been repeatedly proved, and it only remains to make sure that the materials used are correct. Beneficial results are bound to follow if these precautions are taken.

Herd Number Thirty-Nine.—The farm on which this test herd was located was in the northeast quarter of Section 12, Jackson Township. The animals were first seen on November 13, 1907, and at this time 2 old sows and several shoats were quite sick. One of the sick shoats was killed and opened up for the purpose of making a positive diagnosis. The findings were those of hog-cholera, but were not as marked as those often seen in a

case of the acute form of the disease. The sick and well animals had all been running together, and all the herd was exposed, with the exception of 5 male shoats that had been kept confined in a hog-shed removed from the balance of the drove.

There were 28 shoats in the herd that would weigh between 100 and 150 pounds. These had all been exposed to the disease, and each was given 40 to 50 c.c. of the serum alone. One shoat that was quite sick received 80 c.c. of serum. The 5 boars that had not been exposed directly to the sick animals were each given 50 c.c. of serum. These boars weighed about 175 pounds each. One old sow that was sick at the time of treatment was injected with 100 c.c. of serum. Another old sow that was sick did not receive treatment. Ten shoats of various ages and sizes were left untreated to serve as checks.

Final report on this herd showed that 3 of the treated animals, including the sick shoat which received 80 c.c. of serum, died. The balance of the treated animals all survived, and appeared to be thrifty and well on last inspection. All of the untreated checks died except 2. One of these did not become sick; the other one passed through an attack of the disease, but was left stunted and valueless.

Results from the use of serum in this herd are very encouraging. Here the outbreak was already under good headway, and if temperatures had been taken a large percentage of the treated animals would no doubt have been found sick at the time of injection. In spite of this fact, only 3 died after the treatment was given, and one of these was in an almost dying condition when given the large dose of serum. The old sow that received 100 c.c. of serum was among those that recovered. The postmortem findings were not those of an acute form of the disease, but the fact that all but 2 of the checks died is good evidence that the losses would have been very much higher without the use of serum.

In the case of the one untreated check that did not take the disease we have another example of those occasional cases of natural immunity that are met with. Frequently during an outbreak on a farm one, two or more of the hogs will be able to fight off the germs and keep well.

The 5 boars that were injected did not afterward become sick,

smaller amount of serum in comparison to size than is used in the smaller pigs.

The results in this herd also offer conclusive proof of the fact that it is not too late to accomplish a great amount of good with the serum treatment even after the disease has made its appearance in a herd. Use of the serum should be advised even in infected herds unless the animals are so far advanced in the disease as to be plainly hopeless. Even in the cases that are well advanced surprising results are now being reported by the use of large doses of serum. In the case of valuable pure-bred animals there should be no hesitancy in making use of the chance that offers.

While working in Pettis County, Missouri, in the summer of 1913 I injected, in company with other Bureau of Animal Industry veterinarians, a sow and litter of pigs that were well advanced with the disease. The sow was very sick, refused all food, and was scarcely able to stand. The pigs were also markedly affected, and all showed a high temperature at time of injection. In this case large doses of serum alone were used. Each of the little fellows, weighing about 20 pounds each, received an injection of 30 c.c. of serum, while the old sow received 100 c.c.

As the temperatures in these animals were very high, little or no hope was expressed for a favorable outcome, the use of the serum in this case being purely an experiment. The results obtained, however, were most surprising. Only one of the pigs died after receiving treatment. The old sow and the balance of the litter made a brilliant recovery, and were unquestionably saved by the large doses of serum that they had received.

Herd Number Thirty-six.—This herd was located in the northeast quarter of Section 8, Grant Township, and when first seen on November 8, 1907, was thought to be infected with hog-cholera. One old sow in the herd showed symptoms resembling those of cholera at the time the first inspection was made. As it was regarded as probable that the disease already existed in the herd, serum alone was used.

Four old sows were each given 40 c.c. of the serum. Seven young boars, each weighing about 150 pounds, were injected with 20 c.c. each of serum, and 3 shoats of larger size were given 30 c.c. each. The old sow which was sick and a number of shoats of

various sizes were left untreated to serve as checks. The old sow finally recovered, and, as there was no further sickness either among the treated or untreated animals, it must be concluded that hog-cholera did not really exist in the herd.

This is another example of the fact that not every disease of hogs showing loss of appetite, droopiness, and cough or diarrhea is hog-cholera. It may be stated, however, that in over 90 per cent. of such cases hog-cholera will be found to be the correct diagnosis, and so seldom is any other disease present that it is the part of wisdom to administer the serum at once, without waiting for an animal to die in order to make sure of the diagnosis. If the disease is not cholera, no damage will be done by giving the serum, and if cholera is really present every hour that the administration of serum is delayed just means that much of an increase in the number of animals that cannot be saved.

There is a little subsequent history attached to this last-mentioned herd that is of particular interest. The owner of these animals sold them at public sale the following spring, and some of them were purchased by a man who had had hog-cholera on his farm. These animals were taken home and placed in the infected feed lots, where they very promptly contracted hog-cholera and died.

This gives us again an example of the fact that the protection given by the administration of the serum alone is only temporary. It is only when the virus is used, or when it is already present in the animal at time of injection, that a permanent immunity is obtained. The great advantage of the double method of treatment lies in this very fact, that the animals after treatment can be removed to another farm where hog-cholera is present, or has been present, and can be placed in the disease-infected feed lots without danger. If they have been double treated with a virulent virus blood there is no danger, as the protection derived from this treatment lasts as long as the animals live. On the other hand, where single treatment is used, and months afterward the animals are moved to an infected feed lot, sickness and death are sure to follow.

Herd Number Thirty-seven.—The thirty-seventh herd treated in the series was located in Section 21, Washington Township.

somewhat smaller than these, was injected with 50 c.c. Thirty-six spring gilts, averaging about 200 pounds, received 50 c.c. each. Twenty fall pigs, that would weigh from 25 to 30 pounds, were given 20 c.c. each.

Six spring boars, averaging about 175 pounds each in weight, 1 old sow, 4 of the 200-pound spring gilts, and 30 of the fall pigs were left untreated to serve as checks.

Final reports on this herd show most positive evidence in favor of the use of serum in a herd even after hog-cholera has made its appearance. The disease had already been present on this farm several days when the treatment was given, and one hog had already died. If temperatures had been taken at the time of injection it is highly probable that at least 50 per cent. of the hogs treated would have shown a high temperature. In spite of this fact, the official report on the herd shows that only 4 of the treated gilts and 3 of the fall pigs died. Two other treated gilts showed symptoms of the disease, but recovered. The balance of the treated animals remained well and in perfect condition.

This in itself is a very pleasing statement, but it is made much the more noteworthy when we consider the outcome in the untreated checks. All of the 30 fall pigs left untreated died. Four of the 6 boars died, so also did the old sow and 2 of the 4 gilts. The other 2 gilts sickened, but recovered.

More convincing proof of the value of hog-cholera serum as a method of treatment for cholera could hardly be asked. This report would be the more positive in its assurance if the temperatures of the treated hogs had been recorded. They would unquestionably have shown that a large number of these animals were sick on the day of injection. It was due to the serum alone that the death-rate was held down to practically nothing as compared with that in the hogs that received no serum.

Hog-cholera serum we will find, the more we experiment with it, is not only a preventive for cholera, but it will also save thousands of cases even after the disease has made its appearance among the herd. At the first sign of cholera, get a man with a reliable serum on the farm and have every hog treated. Those that show a high temperature to receive serum alone, while those that do not show any fever may well be given the simultaneous

injection. This will save nearly every one of the animals, even those that show a high temperature being saved in the majority of cases.

This outbreak gives again a warning of the danger which is associated with the bringing of hogs from a strange farm and placing them with the home herd. It makes no difference whether they come from a pure-bred farm or not, every new hog brought on the place should be kept separate from the balance of the herd for at least twenty-one, and preferably thirty, days to make sure that he is not suffering from cholera or some other disease which might be transmitted to the balance of the drove.

The extremely high death-rate in the untreated check pigs of this lot again shows that cholera is very severe and fatal in young animals. The severity of the outbreak among all the animals attacked on this farm would seem to offer further proof that pure-bred hogs are perhaps less resistant to cholera than some of the grade stock.

Herd Number Forty-three.—This herd was located in an adjoining farm to Herd 32, and very likely became infected from the animals of this herd. At the time of the first inspection by the Bureau of Animal Industry veterinarians there were 3 of the shoats sick. The one that appeared the sickest of the 3 was slaughtered, and a postmortem examination made to make positive the diagnosis of cholera. The usual signs of cholera were found, including swollen, discolored lymph-glands, turkey-egg spotted kidneys, spotting of the lungs, and swollen, engorged spleen.

In handling this herd 60 c.c. of serum was injected in 4 old sows. Twenty-four gilts, that would average from 100 to 125 pounds in weight each, received 40 c.c. of serum. Eight barrows of the same litters as the gilts received the same size dose of serum. Five pigs of an early fall litter were each injected with 30 c.c. of serum. Fifteen pigs of various sizes and weights were left to serve as checks.

In this herd, again, the final report gives striking proof of the efficiency of serum as a means of combating hog-cholera even after the disease has made its appearance in the herd. Only 3 of the 41 animals that received the serum died. Within a few days after the

This herd was within a half mile of an infected farm, but all the animals were apparently well when first seen. The date of treatment on this farm was November 7, 1907. The herd was made up of pure-bred Berkshires of various ages and sizes.

In this herd 12 shoats, which averaged in weight from 125 to 200 pounds, were each given 30 c.c. of serum with an accompanying dose of 1 c.c. of virulent blood. One shoat, weighing 100 pounds, was given 20 c.c. of serum with 1 c.c. of virulent blood. Three fall pigs, each weighing about 25 pounds, were given 20 c.c. each of serum alone. Five small sucking pigs received 10 c.c. each of serum alone. One old boar was given 60 c.c. of serum plus 1 c.c. of virulent blood. Two old sows received 50 c.c. of serum plus 1 c.c. of virulent blood. Another group of 4 old sows received 40 c.c. each of serum and 1 c.c. of virulent blood.

Two shoats, weighing about 150 pounds each, were left untreated to serve as checks. It was the intention to later on expose these checks, with part of the treated animals, on some nearby infected farm. Owing to the lateness of the season and large amount of other work to be done by the limited force then attached to the Bureau Station at Ames it was impossible to carry out this last part of the experiment.

The later history of this herd shows that neither the untreated checks nor the treated animals became sick. From this report it must be concluded that cholera infection did not reach this particular farm from the adjoining sick herds. The experiment, however, is of interest, in that it gives another illustration of the use of the double treatment in part of a herd without producing any bad effects in the treated or untreated swine. The animals that received the dose of 1 c.c. of virulent blood, in connection with proper dose of protective serum, showed no ill effects from the treatment. Not only this, but they were left in the feed lot with single-treated and untreated animals without producing any cholera in them. This again offers proof of the fact that the use the simultaneous or double method is safe. With a proper dose a tested serum there should be no bad effects in the herds that receive the double injection. These same hogs may be left in the feed lots with unprotected animals without any danger of infection from this source. Of course, infection may reach the feed

lot from other sources, in which cases the unprotected animals would naturally fall victims.

These experiments seem to offer a suggestion, at least, that the virus which is injected into the body of the hog in giving the simultaneous treatment must be so acted upon by the tissue cells of the injected animal and the protective bodies of the serum as to neutralize entirely its disease-producing qualities. As a result, when it leaves the body of the hog so treated it is no longer a disease-producing virus, but is, instead, a neutral substance, entirely incapable of producing harm. It has worn out its disease-producing powers in the battle against the cells of the animal it sought to attack and is now harmless.

It is possible that in some herds hogs are found that are more susceptible to the effects of the cholera germ, and who may suffer mild symptoms of hog-cholera even when given an average protective dose of serum in connection with the virus. These animals are so easily influenced by cholera virus that they need more than the ordinary amount of protection. These same cases of mild cholera may discharge disease-producing germs in their urine and feces, and might infect a feed lot so as to cause an outbreak of cholera in unprotected animals. Such cases are very infrequent, and especially so if a liberal dose of a powerful serum is used.

Herd Number Thirty-eight.—This herd was located in the southwest quarter of Section 26, Franklin Township. The animals of this herd were all pure-bred Duroc-Jerseys, and consisted of old hogs and spring shoats of various sizes. When treated the animals were all in apparently good health. Treatment was given on November 9, 1907.

There were 31 spring gilts in this herd, weighing on an average from 100 to 200 pounds. These each received from 30 to 40 c.c. of serum, in accordance with their weight, and an accompanying injection of 1 c.c. of virulent blood. Sixteen young boars from the same litters, and weighing about the same as the gilts just mentioned, were treated with the same size dose of serum and a 1-c.c. injection of virus. One old boar was injected with 50 c.c. of serum and a 1-c.c. dose of virus blood. Sixteen old sows, weighing from 300 to 400 pounds each, were injected with 50 c.c. of serum and 1

c.c. of virulent blood. Thirteen spring barrows were left untreated to serve as checks.

The final outcome of the experiment in this herd is indeed most interesting. The treated gilts and the untreated barrows remained in the same feed lot for nearly a month, and none of them showed any signs of disease. The last week in November the owner of the herd purchased a young boar from the farm on which Herd Number Thirty-five of this series was located. This boar had passed through a mild attack of cholera, but was apparently entirely well. He was carefully dipped in a disinfectant solution and placed in a pen immediately adjoining the untreated checks. Eight days after his arrival on the premises one of the check shoats was sick. This animal showed the usual symptoms of an attack of cholera—loss of appetite, dulness, inactivity, muscular weakness, and staggering gait. On December 7th this sick shoat died and the body was opened up to make sure of the cause of death. The findings were those commonly met with in hog-cholera. The spleen was swollen and dark in color, the liver was congested and enlarged, the kidneys swollen, softened, and spotted with the typical dark-red dots. In a few days 2 more of the checks were noted to be off feed, and the owner, fearing that he would lose the entire bunch of barrows, sold the remaining healthy 10 for immediate slaughter. The 2 that were sick at this time soon died.

During the entire time the 35 treated shoats were right in the same pen with the sick animals, and not one of them showed the least evidence of being sick. There can be no question but what they were repeatedly exposed to the infectious discharges from the sick shoats that died, but the protection given by the double treatment was so complete as to entirely safeguard them.

On December 4th, of this same year, the owner of the herd held a public sale, at which he disposed of a number of these treated animals. He advertised them as "vaccinated" hogs, and on the day of sale they were guaranteed against taking hog-cholera for a period of two months after removal from the premises. Many of these treated hogs were purchased by farmers whose herds had been entirely cleaned out by cholera during the past fall. They were taken to these infected farms and placed in the disease-scourge

pens, but not a single instance was reported in which any of them afterward became sick.

This is one of the most interesting experiments reported, and the lessons to be learned from it are many:

In the first place, it shows again conclusively that 1 c.c. of virulent blood can be injected into the body of a susceptible animal without any danger, if accompanied by a proper dose of a potent serum. There is absolutely no danger of producing cholera in this manner if the serum used has been properly checked against the virus and proved to have protective power sufficient to neutralize the disease-producing bodies in the virus.

Second, it is shown in this experiment that when the treated animals were placed in the same feed lots and ranges with 15 untreated shoats there was no development of the disease in these animals. The period of four weeks which passed between injection of the treated animals and the development of the first signs of sickness in the check shoat is entirely too long for the average case of cholera. It can be said, with extreme positiveness, that this outbreak in the check shoats did not appear as a result of association with the treated animals.

Very interesting, indeed, is the third point in this instructive experiment: The young boar that had apparently entirely recovered from a mild attack of cholera proves capable of infecting the new herd into which he is introduced. This again serves to illustrate the fact that animals that have even apparently recovered from cholera are unsafe to add to a susceptible herd, unless that herd be first protected by serum or serum-simultaneous treatment. It seems that the hog which passes through what appears to be a mild attack of the disease is even more dangerous than the one that has the disease in the more severe form. The incubation period of eight days which passed between the purchase of this boar and the first signs of sickness in the checks more closely corresponds to the average incubation period of hog-cholera, and there can be but little doubt that this is the source of the infection in this herd.

The results in the treated animals, in the face of an outbreak of the disease, is a fourth point of extreme interest to be derived from the experiment in this herd. With an unquestionable out-

in the same neighborhood as herds Thirty-two, Forty-three, and Forty-four. The animals had become infected probably by spread of the disease from some of the surrounding infected farms. Several weeks before the owner of the herd had obtained from Chicago a supply of commercial serum which he had intended to use if his hogs became sick. When the disease did finally make its appearance he sent for the United States officials, and requested them to treat a part of his herd with government serum for comparison with the results from use of the commercial serum.

Seven old hogs were injected with 40 c.c. each of the government serum. Nine spring gilts received 30 c.c. each and one boar was given 40 c.c. On the same day the owner injected 31 spring shoats with the commercial preparation.

The final report on the results in this herd showed a striking comparison. Of the animals injected with government serum none were lost; of those treated with the commercial product, only 6 were saved!

This is, indeed, a most instructive example of the difference in results where a reliable and a worthless serum are used. In justice to the commercial preparation, it must be said that the conditions under which it was used were unfavorable. This serum had been in the hands of the farmer for several weeks, and it is possible that he may not have understood the need for keeping it at a low temperature, and it may have become spoiled and even infected. In this case, the deaths following its use could not be properly charged to lack of protective power in the serum when it left the hands of the dealer.

The fact remains, however, that a large amount of the commercial serums which have been on the markets in the past five years were worthless, and, worse than that, they were laden with other germs which were capable of producing blood-poisoning and other diseases which would carry off the animal almost as quickly as would cholera itself.

When you are going to use a serum, make certain that the product used is a reliable one. Do not buy an untested serum because it is cheap. The loss of one hog that could have been saved would more than counterbalance any saving in price. Especially I warn you against the use of an untested serum in giving the

simultaneous treatment. If real virus is injected with a poor grade serum a large number of funerals are bound to follow, and confidence in the serum treatment is destroyed, when, as a matter of fact, the trouble is not with the serum, but with the kind of serum used. Make certain that the serum you buy has been really tested against virus or else do not use it except for single treatment.

SUMMARY

In making a survey of these forty-seven clinical reports on the use of serum we must reach the following conclusions:

(1) Hog-cholera serum is in itself a harmless substance, and may be freely injected into well or sick animals without producing any bad results.

(2) The injection of serum in sufficiently large dosage in a herd that has been exposed to cholera, but has shown no symptoms of the disease, will give them a protection against the disease for a time.

(3) This protection given by the serum-alone injection is only temporary in character, and the animals may again take hog-cholera if exposed several weeks later.

(4) Hog-cholera serum, used in larger doses in herds where the disease already exists, will often save a large number of the animals, even saving many that are visibly sick at the time treatment is given. The sooner after the start of the outbreak that serum is used, the greater will be the percentage of hogs saved. Every hour's delay means an increase in the losses.

(5) Injections of 1 to 2 c.c. of virus may be made in a healthy animal without producing disease if a corresponding dose of serum is injected at the same time.

(6) The injection of this double dose of serum and virus not only will not produce disease, but it will result in the development of a permanent protective power against invasion by cholera germs. This is in contrast with the temporary nature of the protection resulting from use of the single method.

(7) The animals which have been protected by the double injection method may be afterward taken to cholera-infected farms and placed in diseased feed lots, or with sick hogs, and they will remain well and thrifty.

smaller amount of serum in comparison to size than is used in the smaller pigs.

The results in this herd also offer conclusive proof of the fact that it is not too late to accomplish a great amount of good with the serum treatment even after the disease has made its appearance in a herd. Use of the serum should be advised even in infected herds unless the animals are so far advanced in the disease as to be plainly hopeless. Even in the cases that are well advanced surprising results are now being reported by the use of large doses of serum. In the case of valuable pure-bred animals there should be no hesitancy in making use of the chance that offers.

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As the temperatures in these animals were very high, little or no hope was expressed for a favorable outcome, the use of the serum in this case being purely an experiment. The results obtained, however, were most surprising. Only one of the pigs died after receiving treatment. The old sow and the balance of the litter made a brilliant recovery, and were unquestionably saved by the large doses of serum that they had received.

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There is a little subsequent history attached to this last-mentioned herd that is of particular interest. The owner of these animals sold them at public sale the following spring, and some of them were purchased by a man who had had hog-cholera on his farm. These animals were taken home and placed in the infected feed lots, where they very promptly contracted hog-cholera and died.

This gives us again an example of the fact that the protection given by the administration of the serum alone is only temporary. It is only when the virus is used, or when it is already present in the animal at time of injection, that a permanent immunity is obtained. The great advantage of the double method of treatment lies in this very fact, that the animals after treatment can be removed to another farm where hog-cholera is present, or has been present, and can be placed in the disease-infected feed lots without danger. If they have been double treated with a virulent virus blood there is no danger, as the protection derived from this treatment lasts as long as the animals live. On the other hand, where single treatment is used, and months afterward the animals are moved to an infected feed lot, sickness and death are sure to follow.

Herd Number Thirty-seven.—The thirty-seventh herd treated in the series was located in Section 21, Washington Township.

ered as a very important disease of the hog, and Dr. Billings, of the University of Nebraska, several years ago wrote a large book which was devoted entirely to a discussion of the disease. At that time a special germ was described and heralded as the cause of swine plague, and an entirely separate set of pathologic findings and clinical symptoms were outlined for the disease from those given for hog-cholera.

In the past few years our opinions regarding swine plague have underwent a great deal of change, and at present it may be rightfully questioned whether there really is such a disease as swine plague. Most of the cases of what was formerly classed as swine plague are now known to be hog-cholera in which the germs are acting principally upon the lungs, and, accordingly, the symptoms are mostly of a pulmonary type. The cough in these cases is a marked feature of the disease.

That there is such a disease as swine plague I think may very reasonably be questioned. It is possible that the disease may, and perhaps does, exist, but it most certainly is only in the form of isolated cases and never as a widespread epidemic such as is seen in hog-cholera. Whenever hogs begin to get off feed, droop, lose energy and liveliness, and die in large numbers without any explainable cause it can be said in ninety-nine cases out of a hundred that the cause of death is hog-cholera.

If there was a second epidemic disease, such as swine plague, it would be of great importance from the standpoint of the use of serum. Serum which would protect an animal against hog-cholera could not be expected to protect hogs that had been exposed to swine plague, no more than small-pox vaccination in the human race could be expected to protect the man from typhoid fever. It would be necessary that we have two forms of serum, one for cholera and the other for swine plague. Fortunately, it has been found with the use of the serum that the two conditions are, in reality, one and the same in almost every instance, the only difference being that in the one case the germs act more powerfully on the lungs, while in another animal they are more active in the bowel, kidneys, and other organs of the abdominal cavity.

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These experiments seem to offer a suggestion, at least, that the virus which is injected into the body of the hog in giving the simultaneous treatment must be so acted upon by the tissue cells of the injected animal and the protective bodies of the serum as to neutralize entirely its disease-producing qualities. As a result, when it leaves the body of the hog so treated it is no longer a disease-producing virus, but is, instead, a neutral substance, entirely incapable of producing harm. It has worn out its disease-producing powers in the battle against the cells of the animal it sought to attack and is now harmless.

It is possible that in some herds hogs are found that are more susceptible to the effects of the cholera germ, and who may suffer mild symptoms of hog-cholera even when given an average protective dose of serum in connection with the virus. These animals are so easily influenced by cholera virus that they need more than the ordinary amount of protection. These same cases of mild cholera may discharge disease-producing germs in their urine and feces, and might infect a feed lot so as to cause an outbreak of cholera in unprotected animals. Such cases are very infrequent, and especially so if a liberal dose of a powerful serum is used.

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There were 31 spring gilts in this herd, weighing on an average from 100 to 200 pounds. These each received from 30 to 40 c.c. of serum, in accordance with their weight, and an accompanying injection of 1 c.c. of virulent blood. Sixteen young boars from the same litters, and weighing about the same as the gilts just mentioned, were treated with the same size dose of serum and a 1-c.c. injection of virus. One old boar was injected with 50 c.c. of serum and a 1-c.c. dose of virus blood. Sixteen old sows, weighing from 300 to 400 pounds each, were injected with 50 c.c. of serum and 1

c.c. of virulent blood. Thirteen spring barrows were left untreated to serve as checks.

The final outcome of the experiment in this herd is, indeed, most interesting. The treated gilts and the untreated barrows remained in the same feed lot for nearly a month, and none of them showed any signs of disease. The last week in November the owner of the herd purchased a young boar from the farm on which Herd Number Thirty-five of this series was located. This boar had passed through a mild attack of cholera, but was apparently entirely well. He was carefully dipped in a disinfectant solution and placed in a pen immediately adjoining the untreated checks. Eight days after his arrival on the premises one of the check shoats was sick. This animal showed the usual symptoms of an attack of cholera—loss of appetite, dulness, inactivity, muscular weakness, and staggering gait. On December 7th this sick shoat died and the body was opened up to make sure of the cause of death. The findings were those commonly met with in hog-cholera. The spleen was swollen and dark in color, the liver was congested and enlarged, the kidneys swollen, softened, and spotted with the typical dark-red dots. In a few days 2 more of the checks were noted to be off feed, and the owner, fearing that he would lose the entire bunch of barrows, sold the remaining healthy 10 for immediate slaughter. The 2 that were sick at this time soon died.

During the entire time the 35 treated shoats were right in the same pen with the sick animals, and not one of them showed the least evidence of being sick. There can be no question but what they were repeatedly exposed to the infectious discharges from the sick shoats that died, but the protection given by the double treatment was so complete as to entirely safeguard them.

On December 4th, of this same year, the owner of the herd held a public sale, at which he disposed of a number of these treated animals. He advertised them as "vaccinated" hogs, and on the day of sale they were guaranteed against taking hog-cholera for a period of two months after removal from the premises. Many of these treated hogs were purchased by farmers whose herds had been entirely cleaned out by cholera during the past fall. They were taken to these infected farms and placed in the disease-bearing

pens, but not a single instance was reported in which any of them afterward became sick.

This is one of the most interesting experiments reported, and the lessons to be learned from it are many:

In the first place, it shows again conclusively that 1 c.c. of virulent blood can be injected into the body of a susceptible animal without any danger, if accompanied by a proper dose of a potent serum. There is absolutely no danger of producing cholera in this manner if the serum used has been properly checked against the virus and proved to have protective power sufficient to neutralize the disease-producing bodies in the virus.

Second, it is shown in this experiment that when the treated animals were placed in the same feed lots and ranges with 15 untreated shoats there was no development of the disease in these animals. The period of four weeks which passed between injection of the treated animals and the development of the first signs of sickness in the check shoat is entirely too long for the average case of cholera. It can be said, with extreme positiveness, that this outbreak in the check shoats did not appear as a result of association with the treated animals.

Very interesting, indeed, is the third point in this instructive experiment: The young boar that had apparently entirely recovered from a mild attack of cholera proves capable of infecting the new herd into which he is introduced. This again serves to illustrate the fact that animals that have even apparently recovered from cholera are unsafe to add to a susceptible herd, unless that herd be first protected by serum or serum-simultaneous treatment. It seems that the hog which passes through what appears to be a mild attack of the disease is even more dangerous than the one that has the disease in the more severe form. The incubation period of eight days which passed between the purchase of this boar and the first signs of sickness in the checks more closely corresponds to the average incubation period of hog-cholera, and there can be but little doubt that this is the source of the infection in this herd.

The results in the treated animals, in the face of an outbreak of the disease, is a fourth point of extreme interest to be derived from the experiment in this herd. With an unquestionable out-

break of hog-cholera in the check shoats kept in the same pen with them, those treated hogs remained well, and not even one of them was found to be off feed at any time. The outbreak in the checks did not occur until over a month after treatment was given. This serves to show that the protection given by the simultaneous method lasts for a long period, and is not merely a temporary one, as in the case of the single treatment. Had these shoats been given the serum-alone method it is quite likely that the protection would have run out in several of them by this time, and the disease would have in this event made its appearance in the treated as well as the untreated portion of the herd.

Any further proof that might be lacking as to the efficiency of the simultaneous injection in this case is given by the after-results, when hogs from this farm were purchased at public sale and taken to other infected feed lots and put in pens where hogs had recently died with cholera, and in some cases, no doubt, with animals that were at the time suffering from the disease. In not one of these cases did the treatment prove ineffective! Not one of the hogs so exposed took the disease! This, even though over two months had elapsed since the injections were made. More convincing proof could hardly be offered than that shown in this case. The simultaneous treatment produced absolutely no ill effects in this herd, and it conferred upon the treated shoats a complete and permanent protection against the germs of hog-cholera.

Equally good results can and will be obtained in other herds when a pure virus and a tested serum are used. The underlying basis of the treatment is sound. Its principles have been repeatedly proved, and it only remains to make sure that the materials used are correct. Beneficial results are bound to follow if these precautions are taken.

Herd Number Thirty-Nine.—The farm on which this test herd was located was in the northeast quarter of Section 12, Jackson Township. The animals were first seen on November 13, 1907, and at this time 2 old sows and several shoats were quite sick. One of the sick shoats was killed and opened up for the purpose of making a positive diagnosis. The findings were those of hog-cholera, but were not as marked as those often seen in a

case of the acute form of the disease. The sick and well animals had all been running together, and all the herd was exposed, with the exception of 5 male shoats that had been kept confined in a hog-shed removed from the balance of the drove.

There were 28 shoats in the herd that would weigh between 100 and 150 pounds. These had all been exposed to the disease, and each was given 40 to 50 c.c. of the serum alone. One shoat that was quite sick received 80 c.c. of serum. The 5 boars that had not been exposed directly to the sick animals were each given 50 c.c. of serum. These boars weighed about 175 pounds each. One old sow that was sick at the time of treatment was injected with 100 c.c. of serum. Another old sow that was sick did not receive treatment. Ten shoats of various ages and sizes were left untreated to serve as checks.

Final report on this herd showed that 3 of the treated animals, including the sick shoat which received 80 c.c. of serum, died. The balance of the treated animals all survived, and appeared to be thrifty and well on last inspection. All of the untreated checks died except 2. One of these did not become sick; the other one passed through an attack of the disease, but was left stunted and valueless.

Results from the use of serum in this herd are very encouraging. Here the outbreak was already under good headway, and if temperatures had been taken a large percentage of the treated animals would no doubt have been found sick at the time of injection. In spite of this fact, only 3 died after the treatment was given, and one of these was in an almost dying condition when given the large dose of serum. The old sow that received 100 c.c. of serum was among those that recovered. The postmortem findings were not those of an acute form of the disease, but the fact that all but 2 of the checks died is good evidence that the losses would have been very much higher without the use of serum.

In the case of the one untreated check that did not take the disease we have another example of those occasional cases of natural immunity that are met with. Frequently during an outbreak on a farm one, two or more of the hogs will be able to fight off the germs and keep well.

The 5 boars that were injected did not afterward become sick,

showing again the protective power of the serum as a preventive measure when injected in a herd that is threatened with cholera.

Herd Number Forty.—The fortieth herd of this experimental series was located in the southwest quarter of Section 7, Washington Township. The farm, while in another township, was quite close to the farm on which Herd Number 39 was located. Hog-cholera had also been present on this premises for about two weeks at the time the United States officials paid their first visit, which was on the same day as that on which Number 39 was treated. Several hogs had already died, and a number of others were sick at this time. One of the sick animals was killed, and a postmortem examination made at this time showed that the findings were those of the slow rather than the acute form of hog-cholera.

Sixteen shoats in the herd, weighing about 100 pounds each, were injected with a dose of 40 c.c. of serum. These shoats had all been exposed to the sick animals, and many of them were undoubtedly beginning to come down with the disease at the time of treatment. As no temperatures were reported on these hogs, it is impossible to say just how many of them were really sick on this date.

Two more shoats that were very sick at the time were injected, one receiving 50 c.c. and the other 60 c.c. of serum alone. Seven shoats, all of which had been exposed, and 2 of which were sick at the time, were left untreated to serve as checks.

Final report on this case shows that the 2 sick checks and the 2 shoats that were sick when treatment was given died. The balance of the herd remained well.

While the final outcome here was very pleasing for the owner, the results do not give such strong indications of the value of serum as some other herds that have been described. The fact that no more of the checks became sick shows that the outbreak had perhaps about run its course on this farm. There can be but little question, however, that many of the injected shoats would have become sick if left untreated, and several of them would no doubt have later died. Absence of temperature makes it a little hard to draw definite conclusions here.

Herd Number Forty-one.—This herd was located in the south-

west quarter of Section 17, Grant Township. The owner had noticed that the animals did not seem to be doing right for several days. When visited by the government officials they showed loss of appetite, and many of them appeared gaunt and unthrifty. None of them were sufficiently sick, however, to justify killing them for the purpose of making a postmortem diagnosis.

In treating the herd the serum-alone treatment was used. Fifty spring shoats, weighing from 125 to 200 pounds, were given 40 c.c. each. One smaller shoat received 20 c.c. of the same serum, and another shoat was given 15 c.c. Fifty-three were left untreated to serve as checks.

The after-history of this herd showed that none of the treated animals or checks died. The herd evidently was not suffering from cholera. The experiment gives an illustration of the fact that not every disease associated with loss of appetite and loss of weight is cholera. This herd was more likely the victim of indigestion, due to improper feeding or perhaps the presence of intestinal parasites. The experiment does show that the injection of serum even in other diseases than cholera does no harm, and it is a wise precaution to use the serum in any suspicious cases, if there be a reasonable likelihood that cholera exists.

Herd Number Forty-two.—This herd was located in Section 21, Franklin Township. There were no cholera-infected farms in the immediate neighborhood of the premises. The herd was made up entirely of pure-bred Chester-White hogs, and consisted of old sows, young spring gilts, young boars, and a number of fall pigs.

At the time the herd was examined and treated hog-cholera had already made its appearance on the farm. This had been brought on the farm by the importation of a breeding animal from a distant part of the state. At the date of treatment one boar had died, 2 others showed symptoms of hog-cholera, and the majority of the herd had been exposed by contact with the sick animals.

In the treatment of these hogs 2 young boars, each weighing about 175 pounds, received 50 c.c. each of serum. One old boar, weighing about 700 pounds, was injected with 60 c.c. of serum. Seventeen old sows, which averaged from 300 to 500 pounds in weight, were each injected with 60 c.c. of serum. One old sow,

somewhat smaller than these, was injected with 50 c.c. Thirty-six spring gilts, averaging about 200 pounds, received 50 c.c. each. Twenty fall pigs, that would weigh from 25 to 30 pounds, were given 20 c.c. each.

Six spring boars, averaging about 175 pounds each in weight, 1 old sow, 4 of the 200-pound spring gilts, and 30 of the fall pigs were left untreated to serve as checks.

Final reports on this herd show most positive evidence in favor of the use of serum in a herd even after hog-cholera has made its appearance. The disease had already been present on this farm several days when the treatment was given, and one hog had already died. If temperatures had been taken at the time of injection it is highly probable that at least 50 per cent. of the hogs treated would have shown a high temperature. In spite of this fact, the official report on the herd shows that only 4 of the treated gilts and 3 of the fall pigs died. Two other treated gilts showed symptoms of the disease, but recovered. The balance of the treated animals remained well and in perfect condition.

This in itself is a very pleasing statement, but it is made much the more noteworthy when we consider the outcome in the untreated checks. All of the 30 fall pigs left untreated died. Four of the 6 boars died, so also did the old sow and 2 of the 4 gilts. The other 2 gilts sickened, but recovered.

More convincing proof of the value of hog-cholera serum as a method of treatment for cholera could hardly be asked. This report would be the more positive in its assurance if the temperatures of the treated hogs had been recorded. They would unquestionably have shown that a large number of these animals were sick on the day of injection. It was due to the serum alone that the death-rate was held down to practically nothing as compared with that in the hogs that received no serum.

Hog-cholera serum we will find, the more we experiment with it, is not only a preventive for cholera, but it will also save thousands of cases even after the disease has made its appearance among the herd. At the first sign of cholera, get a man with a reliable serum on the farm and have every hog treated. Those that show a high temperature to receive serum alone, while those that do not show any fever may well be given the simultaneous

injection. This will save nearly every one of the animals, even those that show a high temperature being saved in the majority of cases.

This outbreak gives again a warning of the danger which is associated with the bringing of hogs from a strange farm and placing them with the home herd. It makes no difference whether they come from a pure-bred farm or not, every new hog brought on the place should be kept separate from the balance of the herd for at least twenty-one, and preferably thirty, days to make sure that he is not suffering from cholera or some other disease which might be transmitted to the balance of the drove.

The extremely high death-rate in the untreated check pigs of this lot again shows that cholera is very severe and fatal in young animals. The severity of the outbreak among all the animals attacked on this farm would seem to offer further proof that pure-bred hogs are perhaps less resistant to cholera than some of the grade stock.

Herd Number Forty-three.—This herd was located in an adjoining farm to Herd 32, and very likely became infected from the animals of this herd. At the time of the first inspection by the Bureau of Animal Industry veterinarians there were 3 of the shoats sick. The one that appeared the sickest of the 3 was slaughtered, and a postmortem examination made to make positive the diagnosis of cholera. The usual signs of cholera were found, including swollen, discolored lymph-glands, turkey-egg spotted kidneys, spotting of the lungs, and swollen, engorged spleen.

In handling this herd 60 c.c. of serum was injected in 4 old sows. Twenty-four gilts, that would average from 100 to 125 pounds in weight each, received 40 c.c. of serum. Eight barrows of the same litters as the gilts received the same size dose of serum. Five pigs of an early fall litter were each injected with 30 c.c. of serum. Fifteen pigs of various sizes and weights were left to serve as checks.

In this herd, again, the final report gives striking proof of the efficiency of serum as a means of combating hog-cholera even after the disease has made its appearance in the herd. Only 3 of the 41 animals that received the serum died. Within a few days after the

injections were given 4 of the check animals had died, and the owner, fearing that they would all be lost, sold the remaining 11 to a local shipper. Had they been left on the farm the chances are that nearly if not all of them would have died.

It will be seen that in this herd the serum practically checked the outbreak at once. Three hogs were quite sick on the day that the herd was treated. Only 3 were lost afterward. If temperatures had been taken, there is no question but what a large number of the shoats which did not show visible signs of the disease would have been found to be developing hog-cholera.

The final report of this experiment gives a very good example of one of the ways in which cholera is spread where no quarantine regulations are applied to farms on which the disease exists. Eleven exposed hogs were here sent to market and transported over public highways and through public stock-yards. It is through this manner of handling the disease that cholera is able to get such a quick, widespread distribution in a neighborhood or community. Sick herds should be quarantined, and not allowed to pass over public roadways to scatter infection to adjoining farms.

Herd Number Forty-four.—This was another herd located in the neighborhood of Herds Thirty-two and Forty-three. When the Bureau Inspectors visited this farm they found things in a very bad way. The animals were in such a serious condition, and the disease had obtained such a headway, that it was hardly worth while, apparently, to use any serum on them. The owner, however, had seen the results obtained on other farms in the neighborhood, and he was very anxious to have his hogs treated. Nearly all of the hogs were sick at the time, and the symptoms were unmistakably those of genuine hog-cholera.

There were 17 shoats, averaging up to 100 pounds, in the herd. Many of these shoats were visibly sick at the time. They were all injected, however, receiving from 20 to 60 c.c. of the serum. Fourteen small pigs, which were all more or less sick, were also injected, receiving 10 c.c. each of serum. Two shoats and 5 small pigs were left untreated, to serve as checks.

Final report on this herd showed fairly good results. Twelve of the treated shoats and one of the checks lived through. All of the pigs, both treated and untreated, died. While this report is

not as brilliant a one as some that have been already shown, yet it is a very good showing when it is taken into consideration that almost every hog on the place was very sick at the time when the treatment was given. In the case of the small pigs, I am of the opinion that some of these might have been saved had the dose of serum used been larger; 10 c.c. of serum is sufficient in very small pigs to act as a protective dose, but where the cholera germs have already begun their attack and visible symptoms of cholera are present it would seem wise to give a considerably larger dose, even to sucking pigs.

This outbreak was unquestionably a virulent one, as shown by the result in both treated and untreated animals, and it is doubtful if more than 2 or 3 shoats would have survived if the serum had not been used. The results here obtained should encourage stockmen and veterinarians to make use of high-grade serum even after the disease has made a good start. This is especially to be advised where the herd consists of a number of pure-bred hogs, the saving of one of which would more than repay for the cost of the serum used in the entire herd.

Herd Number Forty-five.—This herd was located in a somewhat different locality from most of those already reported. The farm on which these animals were kept was in the outskirts of Nevada, Iowa. Hog-cholera had been raging in the surrounding neighborhood for several weeks. Infection had already reached the farm at the time the United States veterinarians visited the premises, and many of the hogs were already visibly sick with symptoms that were unquestionably those of genuine cholera.

Four of the animals had already died at this time, and a number of the remaining shoats were off feed and showed marked signs of the dread disease. One of the dead animals was opened and the findings were those usually seen in an acute case of hog-cholera. Here, again, was a herd that could not be regarded as favorable for injection with serum, but as the owner was very anxious to try and save some of his herd treatment was administered.

Twenty-nine shoats, varying in size and weight, were injected, each receiving 40 c.c. of serum. Three old hogs of large size were each injected with 80 c.c. of serum. Thirteen of the shoats were left untreated, to serve as checks.

The final report on this herd showed a much better outcome than might have been expected. Of the 29 shoats treated, only 3 died, and of the 3 old hogs treated, none were lost. Five of the 13 shoats left as checks died. This was a very pleasing result, and shows again that even hogs that are sick with cholera at the time of treatment can often be saved if a good-sized dose of serum be given. It would be very interesting, indeed, to have the temperatures of these animals as a guide to just how many of the injected shoats were coming down with cholera on the date treatment was given. With the use of somewhat larger amounts of serum in the shoats, I am of the opinion that even a better result might have been shown. The amount injected in the old sows is nearer to the dose which should be used where cholera already exists, as shown by a high temperature and visible symptoms of the disease.

Herd Number Forty-six.—The farm on which this herd was located was in the same neighborhood as Herd Number Forty. The disease, however, did not spread to this farm until the latter part of December. At the time when the government veterinarians were called several of the hogs had already died and a large percentage of those remaining were taken sick. One of the very sick animals was killed and the body opened for postmortem examination. The enlarged spleen, spotted kidneys, enlarged liver, swollen and discolored lymph-glands, and other changes typical of cholera left no doubt as to the correct diagnosis of the disease. This herd had been following a bunch of feeding cattle and were in excellent condition when the disease struck them.

In the same yard with the sick hogs there were 55 shoats which were all exposed to the disease, and many of them, no doubt, already coming down with the disease. As no temperatures are recorded, it is impossible to say just what percentage were developing cholera. These shoats were injected with the serum alone, each animal receiving 40 c.c.

Fifteen shoats of larger size, averaging about 250 pounds, were being fattened in a separate lot, which immediately adjoined the cattle lot in which the sick hogs were running. These large shoats were injected with 30 to 50 c.c. of serum each. Four old hogs were also injected with 50-c.c. doses of serum. Ten shoats of the smaller

size were left untreated to serve as checks on the results of the serum.

Results shown in the final report on this herd are indeed most pleasing, and give an excellent example of what may be expected when a high-grade serum is used. Out of the 70 shoats that were injected, only 9 died. This in spite of the fact that 55 of the animals had been for several days in the same feed lot with the shoats that had died, and the other 15 had been in a lot which joined fences with the infected feed lot. If temperatures were available on these shoats over 50 per cent. of them would undoubtedly have been found to have a high fever, showing that they were developing the disease.

Evidence of the virulent nature of the disease on this farm is offered in the report on the checks, showing that 7 out of the 10 left untreated afterward died.

Such results as this should encourage any man to make an effort to have his herd treated although the cholera has made a start. Even after several hogs have died, as in the case here shown, it is often not too late, if a reliable serum is used and the dose increased to the point where it can be expected to overcome the large amount of poisonous bodies that have already begun to attack the cells of the animal body. Of course, every hour that is lost in getting the treatment to the herd means an increased amount of these poisonous bodies in the blood of the sick hog, and means a much bigger task for the serum to accomplish. Every hour saved means just that much larger percentage of animals that will be saved. The better method, of course, is to have the double treatment given before cholera gets on the farm, but in cases where this is not done, it is not too late to make use of the serum even after visible signs of the disease have shown themselves. Remember that serum is not claimed to be a curative for all cases of cholera. Some do not even claim any curative properties for it whatever. I have seen sufficient proof of benefit following the use of the treatment in sick hogs that I am convinced that these men are overconservative in their statements. Many sick animals can be saved with serum if the serum used is of proper strength and the dose sufficiently large.

Herd Number Forty-seven.—This was another herd located

simultaneous treatment. If real virus is injected with a poor grade serum a large number of funerals are bound to follow, and confidence in the serum treatment is destroyed, when, as a matter of fact, the trouble is not with the serum, but with the kind of serum used. Make certain that the serum you buy has been really tested against virus or else do not use it except for single treatment.

SUMMARY

In making a survey of these forty-seven clinical reports on the use of serum we must reach the following conclusions:

(1) Hog-cholera serum is in itself a harmless substance, and may be freely injected into well or sick animals without producing any bad results.

(2) The injection of serum in sufficiently large dosage in a herd that has been exposed to cholera, but has shown no symptoms of the disease, will give them a protection against the disease for a time.

(3) This protection given by the serum-alone injection is only temporary in character, and the animals may again take hog-cholera if exposed several weeks later.

(4) Hog-cholera serum, used in larger doses in herds where the disease already exists, will often save a large number of the animals, even saving many that are visibly sick at the time treatment is given. The sooner after the start of the outbreak that serum is used, the greater will be the percentage of hogs saved. Every hour's delay means an increase in the losses.

(5) Injections of 1 to 2 c.c. of virus may be made in a healthy animal without producing disease if a corresponding dose of serum is injected at the same time.

(6) The injection of this double dose of serum and virus not only will not produce disease, but it will result in the development of a permanent protective power against invasion by cholera germs. This is in contrast with the temporary nature of the protection resulting from use of the single method.

(7) The animals which have been protected by the double injection method may be afterward taken to cholera-infected farms and placed in diseased feed lots, or with sick hogs, and they will remain well and thrifty.

(8) Hogs that have received the simultaneous treatment can be left in the same lots with untreated hogs without danger to the untreated animals. The virus injected into the hogs that are treated will not infect the untreated hogs unless some of those that are treated become sick.

(9) In an occasional case some of the hogs that receive the simultaneous method may prove to be unusually susceptible to the action of cholera virus and may develop symptoms of an attack of cholera.

(10) These cases should immediately receive a second injection with serum alone in large doses. This method of handling the case will nearly always check the threatened outbreak.

(11) Those cases in which an attack of cholera follows use of the simultaneous method are nearly always due to some avoidable cause, such as poor serum, too large dose of virus, not enough serum, or injection of double treatment in hogs that are already coming down with a natural infection.

OTHER INFECTIOUS DISEASES

SWINE ERYSIPELAS

Definition.—This disease, which is also known under the names of red fever of swine, rouget du porc, and rotlauf, is a contagious germ-produced disease of swine which is seen in many of the hog-producing countries of Europe. Swine erysipelas is not seen in hogs in the United States. The cause of the condition is a germ which is known as the bacillus of swine erysipelas, or Bacillus rhusiopathiæ suis.

This germ enters the body of the animal in very much the same way as does the virus of hog-cholera. After an incubation or development period of three days the hog is suddenly seized with a chill. The animal shivers, the limbs are alternately hot and cold, the visible lining membranes of the mouth, nose, and eyes become very dark or violet colored, and the temperature quickly shoots up to 104° F. or even as high as 106° F. The skin becomes very red in color, often showing a dark or violet discoloration. Death occurs very early in the disease, often being preceded by muscular weakness, staggering gait, and other symptoms very suggestive of cholera.

On postmortem examination the internal viscera are found to be very much congested, but there is an absence of ulcers in the intestine and also an absence of the speckled kidney, so characteristic of hog-cholera.

Diagnosis is made from hog-cholera by the shorter incubation period, more violent onset, dark discoloration of the visible membranes, and the more pronounced discoloration of the skin. The absence of the usual postmortem findings of cholera, and the fact that the disease is unknown in the United States, are also important factors in ruling out swine erysipelas as a cause of death in American swine.

SWINE PLAGUE

This is a disease about which there has been and is even now a great deal of argument. At one time swine plague was consid-

ered as a very important disease of the hog, and Dr. Billings, of the University of Nebraska, several years ago wrote a large book which was devoted entirely to a discussion of the disease. At that time a special germ was described and heralded as the cause of swine plague, and an entirely separate set of pathologic findings and clinical symptoms were outlined for the disease from those given for hog-cholera.

In the past few years our opinions regarding swine plague have underwent a great deal of change, and at present it may be rightfully questioned whether there really is such a disease as swine plague. Most of the cases of what was formerly classed as swine plague are now known to be hog-cholera in which the germs are acting principally upon the lungs, and, accordingly, the symptoms are mostly of a pulmonary type. The cough in these cases is a marked feature of the disease.

That there is such a disease as swine plague I think may very reasonably be questioned. It is possible that the disease may, and perhaps does, exist, but it most certainly is only in the form of isolated cases and never as a widespread epidemic such as is seen in hog-cholera. Whenever hogs begin to get off feed, droop, lose energy and liveliness, and die in large numbers without any explainable cause it can be said in ninety-nine cases out of a hundred that the cause of death is hog-cholera.

If there was a second epidemic disease, such as swine plague, it would be of great importance from the standpoint of the use of serum. Serum which would protect an animal against hog-cholera could not be expected to protect hogs that had been exposed to swine plague, no more than small-pox vaccination in the human race could be expected to protect the man from typhoid fever. It would be necessary that we have two forms of serum, one for cholera and the other for swine plague. Fortunately, it has been found with the use of the serum that the two conditions are, in reality, one and the same in almost every instance, the only difference being that in the one case the germs act more powerfully on the lungs, while in another animal they are more active in the bowel, kidneys, and other organs of the abdominal cavity.

INFECTIOUS SORE MOUTH (NECROTIC STOMATITIS)

In the section on Diseases of the Digestive Tract the causes, symptoms, and treatment of the simple inflammations of the mouth were given. There is sometimes seen in the hog, as well as in other animals, a form of sore mouth which is due to a specific germ, known as the necrosis bacillus. This type of the disease is known as infectious stomatitis, or necrotic stomatitis, and is a serious and often alarming disease.

Causes.—This disease is seen almost exclusively in young pigs under two months of age. The great predisposing factor in the development of infectious sore mouth is filth. Dirty hog lots, filthy feed troughs, mud-holes, large accumulations of manure in the feed lots, poorly ventilated sleeping quarters, allowing hogs to burrow under manure piles and straw stacks, and feeding of decomposing garbage and filthy slop are the essential points in opening the way for infection by the necrosis bacillus. This germ is always found in the intestine of the hog, and is an important factor in the development of the ulcers of hog-cholera. This is the germ which was found in these lesions several years ago and was believed by many to be the actual cause of hog-cholera. It has since been shown that this was an error, and it is now known that the necrosis organism merely enters after the cholera germ has broken down the tissues and completes the work of forming a slough and ulcer.

Necrotic stomatitis may rapidly spread through an entire litter of pigs by the teats of the sow becoming infected and scattering the germs to every one of the sucking pigs.

The necrosis germ does not seem able to get a hold on a normal healthy membrane. It is necessary for some abrasion to already exist before the germs are able to get the necessary start. This may be caused by the eruption of the teeth, by injury from some sharp-pointed object, or through a simple inflammation of the lining of the mouth.

Symptoms.—At the onset the symptoms are much like those of a simple sore mouth, but are much more severe. The pig refuses to suck, or eat, if it be already weaned. There is some rise in temperature and the pig acts dull and listless. If the mouth be carefully examined at this time it will show a number of in-

flamed patches, especially on the gums and lips. At this early stage of the disease the spots are of a deep-red color, quite dark, and the gums are seen to be considerably swollen. In the severe cases the snout and lips become so badly swollen as to close up the nostrils and seriously interfere with breathing.

At a little later stage these spots become the seat of deep necrotic ulcers. The margins of the ulcer are seen to be very much inflamed and thickened, while the necrotic slough in the center is white or yellowish white in appearance. After these sloughs separate they leave a deep cavity or depression which shows an ulcerated base and is very obstinate in healing. The gums may slough away so extensively as to involve several of the teeth, and the ulcers in the snout and lips may be so deep as to extend entirely through to the outer surface.

Pain becomes a very marked symptom, and the least movement of the jaws is accompanied by intense suffering. The pig is unable to eat on account of this severe pain, and rapidly loses weight and strength. The decomposed sloughs give off a most disagreeable odor from the mouth, and the animal is both a disgusting and a pitiable object. The little sufferer usually becomes separated from the balance of the litter, and remains in the nest or off in some corner by himself. All ambition and vitality is gone. The poisonous materials from the necrotic areas in the mouth are absorbed into the system and produce a profound intoxication.

Course.—The course of this disease is fairly rapid, and it usually terminates in from three to ten days. Necrotic sore mouth is a very serious condition, and nearly half the pigs affected die. If the vitality of the litter is already poor, owing to improper feeding of the mothers and poor sleeping quarters, the disease may wipe out the entire litter, as these weakened pigs are in no condition to stand a severe toxic infection.

Treatment.—In the prevention of this form of stomatitis there are two very important general lines to be followed, one with the object of preventing the appearance of the disease in the herd, the other with the purpose of preventing its spread should it get a start. As a precaution against occurrence of infectious sore mouth the feed lots should be kept in a clean condition, and especially

should all manure be kept cleaned out of them at frequent intervals. Once or twice a month they should be sprinkled with some disinfectant solution.

Isolation.—Immediately that the disease is seen in the pens the affected pigs should be removed from the balance of the litter, as it is only by prompt carrying out of this precaution that the rapid spread of the disease can be prevented. It is also wise to separate the mother from the rest of the herd, as pigs from other litters may suckle the infected teats and develop the disease.

Medicinal Treatment.—Active medicinal treatment of this form of sore mouth must be very vigorous if good results are to be obtained. The mouth should be irrigated with some strong disinfectant solution. For this purpose, perhaps, permanganate of potash is as effective as any other remedy. In making the solution, about 1 ounce of potassium permanganate should be used to the gallon of water. Following the irrigation of the mouth, the ulcers themselves should be touched up with a strong caustic preparation. For this purpose silver nitrate is the most effective agent obtainable. This drug can be obtained in small sticks, known as lunar caustic. Dip the end of one of these sticks in a little water and then thoroughly rub over the surface of the ulcer. This treatment should be repeated once or twice a day for several days.

Where large numbers of the animals are affected, and where it is inconvenient to take the time necessary to apply this thorough treatment, a simpler method consists in making up a bucket of the permanganate solution or a 4 per cent. solution of one of the coal-tar disinfectants, and, taking the affected pig by the hind legs, dip him head foremost into the solution. In this manner the ulcerated surfaces are brought in contact with the disinfectant. Another recommended treatment is to place in the mouth of each affected pig a small teaspoonful of flowers of sulphur.

On account of the severe nature of the disease, and the fact that most of the pigs that recover are left as stunted runts, it is really more economic to knock the badly affected cases in the head rather than to bother with treating them. In cases that recover it is advisable to administer a tonic treatment for a few weeks in order to restore strength, appetite, and vitality.

BLOOD-POISONING (SEPTICEMIA, PYEMIA)

Definition.—By blood-poisoning we understand a condition in which there is the entrance into the circulating blood of disease-producing germs in large numbers, with the formation of a large amount of poisonous materials which cause symptoms of severe toxic nature to develop. In scientific literature this condition is called septicemia, which means literally poison in the blood. In some cases the germs present are those which cause the production of pus and formation of abscesses. In such cases there is pus found in the blood-stream, and numerous abscesses develop in different parts of the body. This is what is known as pyemia, or pus in the blood. It differs from simple blood-poisoning, in that in

Fig. 77.—Pus with staphylococci (× 800) (Flügge).

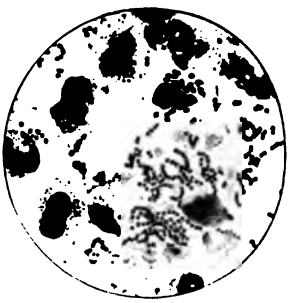

Fig. 78.—Streptococcus pyogenes in pus (× 1000) (Fränkel and Pfeiffer).

addition to germs and their poisons there is pus circulating in the blood. Of the two conditions, the one that is most commonly met with in the hog is pyemia. On the meat inspection floors of our large packing houses this condition in hogs is a quite frequent occurrence. Over 5000 hog carcasses are condemned for this cause every year in government inspected plants.

Causes.—The principal causes for blood-poisoning of every type is neglect of ordinary wounds. These wounds, becoming infected, serve as an avenue of entrance for the germs, which in this manner reach the blood-stream. Filthy feed lots, dirty hog wallows, and similar insanitary surroundings increase the chances for blood infection. Another common starting-point for blood-poisoning is from an infection of the womb following birth of a litter. The

germs from the womb may enter the blood-vessels and set up a general blood-poisoning. This form is more often of the type of a septicemia. That resulting from wounds often develops into a pyemia in hogs.

There may be a number of varieties of germs present in these blood-poisoning cases. The ordinary pus germs, such as the Staphylococcus albus and aureus and the streptococcus, are those most commonly found.

Symptoms.—If a wound be present as the cause of the disease, it will be here that the first symptoms are noted. The condition of the wound shows a marked change. It becomes red and angry looking, and the edges may become swollen. The discharge often becomes of a thin, watery character and very foul smelling. In the course of a few hours the animal may be seized with a severe chill. The fever now rises quickly to 105° or 106° F. Appetite is lost, the animal becomes dull and stupid, and remains buried in its nest. There may be constipation, or in severe cases a very foul-smelling diarrhea may develop.

If the case is prolonged and of the pus-forming type, the hog may show periods of improvement and relapse. Some days the fever is low and there may be some appetite. In a short time a chill again occurs, the temperature goes up, and the hog is again listless and dull. Abscesses may form beneath the skin in various parts of the body. These abscesses also form in the internal organs, and cause various symptoms as a result of changed function of these parts. For instance, abscesses may form in the liver, and result in a severe jaundice, with a greenish-yellow discoloration of the visible membranes and of the skin, which is quite noticeable in those parts of the body where the skin is thin, and especially so in white animals. Abscesses may develop in the lungs, and interfere considerably with breathing. In all these cases the sick hog becomes very unthrifty in appearance, loses weight, and soon becomes worthless.

Course.—The course of the disease varies from a few hours to several weeks. In severe cases of blood-poisoning the poisons of the germs kill the animal in a few hours. In the abscess-forming cases the course is more prolonged, and the hog may live for several weeks or even months. Recovery is almost impossible in these

long-drawn-out cases, and, even if the disease should be checked, the animal is so stunted as to be worthless.

Postmortem Diagnosis.—If the carcass of an animal dead from blood-poisoning be cut open and examined it is usually easy to make a diagnosis if the case be one of the pus-forming type. Abscesses will be found scattered all through the internal organs. Often several of them can be seen in the liver, spleen, lungs, kidneys, and in the fat surrounding the intestines. In severe cases large abscesses may even involve the muscles and the heart.

In those cases that are simply a blood-poisoning the postmortem diagnosis is not always so easy, and it may require an expert meat inspector to tell these cases. The principal findings are failure of the carcass to get stiff after death, as a normal carcass should do. If the animal has been slaughtered there is a failure to bleed properly. The lining membranes of the chest and belly cavities rapidly lose their bright, shiny appearance and become dark in color. In a healthy hog this shiny appearance lasts for several hours, and the membranes never take on a dark color. The meat also decomposes rapidly in an animal that has died of blood-posioning. Numerous small spots of hemorrhage similar to those seen in the kidneys in hog-cholera may occur in various parts of the body.

Treatment.—The treatment of blood-poisoning is almost entirely prevention. With proper handling of wounds, proper cleaning of knives, syringes, and other instruments handled in operations, and careful attention to sows following difficult births, blood-poisoning should not occur. In this connection it is especially important to call attention to a cause for this condition which is of great importance at the present time. This is the injection of hog-cholera serum. In connection with the use of the serum treatment for cholera we have several opportunities for producing fatal blood-poisoning. If the serum used be made carelessly, and without due regard to cleanliness, it may contain large numbers of these germs which cause blood-poisoning, and when such a serum is injected into the body of the animal it is certain to produce very disastrous effects. In cases where the serum is left exposed in a warm room for several days or left in open bottles the danger becomes many times multiplied. This is the reason that such stress has been

laid upon keeping cholera serum cool at all times. Even the best of serum may contain a few germs, but this small number will do no harm unless they get a chance to multiply. Germs will not grow if the fluid in which they exist is kept at a low temperature. If the serum is kept cool we will, accordingly, have little or no increase in the number of germs contained. If, on the other hand, the serum be allowed to get warm, and remain so for some time, the bacteria rapidly multiply, and in a short time the serum simply swarms with them.

Dirty Needles.—Another source of danger in the use of hog-cholera serum consists in the use of unclean syringes and needles, and lack of care in cleansing and disinfecting the skin at the point where the needle is to be inserted. Neglect in this matter may often result in carrying of germs into the tissues, which form an abscess at the point of injection. Germs from this point may enter the blood and set up a generalized pus infection, with development of numerous abscesses throughout the body.

Many of the bad results charged to serum are traceable to serum that contained large numbers of germs when injected, or to the use of dirty syringes, carelessness in cleaning the skin, and other negligences that often prove costly.

Proper Care of Wounds.—As a precautionary measure against blood-poisoning, all wounds, whether accidental or surgical in nature, should receive careful attention. Antiseptic applications and dressings should be used until the injury is sufficiently recovered from to be out of danger of septic infection. If abscesses form, they should be opened at the lowest point and the pus allowed to freely drain. The wound should be kept open until it has healed up from the bottom and danger of infection is over. In sows after farrowing, if their is any indication of infection, treatment should be started quickly in order to avoid serious consequences. The danger of infection of wounds can be very much decreased by keeping feed lots, hog sheds, and similar places in a cleanly condition. A hog with an open wound or ulcer that is wallowing around in a filthy feed lot, in mud up to her belly, and eating corn and other feed out of the mud, cannot help but become the victim of blood-poisoning. The wonder is that more of them do not die.

The active treatment of septicemia must be quickly started if

it is to be of any benefit. The wound which is the seat of entrance of the germs must be thoroughly opened up and allowed to drain. It should then be irrigated out with a 4 per cent. solution of some of the coal-tar disinfectants, or with a 1 : 2000 bichlorid of mercury solution. Another good method is to saturate the inside of the wound with tincture of iodin.

As soon as signs of infection are noted the hog should be placed in a separate pen, fed with light foods, given plenty of water, and kept warm. Internally the best agents for use are *echinacea*, which should be given in half-teaspoonful or teaspoonful doses of a good fluidextract, or the specific medicine, *whisky*, *quinin*, and *strychnin*. Quinin and whisky are especially effective, and when given in combination with echinacea constitute about all that is necessary in the treatment of this condition. After the animal has recovered it is wise to keep up a bitter tonic condition powder for several weeks for the purpose of improving the general condition.

Blood-poisoning is, however, a very serious condition, and in spite of the best of management many of the cases die. The proper time to treat blood-poisoning is before it occurs. Prevent the disease by proper treatment of wounds. This is the way to prevent losses from this source.

Open Abscesses.—In cases of pyemia, where multiple abscesses form beneath the skin, they should be opened, drained, and kept open until all pus formation has been checked and the abscess cavity heals from beneath. In this form of blood-poisoning the internal administration of quinin, whisky, echinacea, and strychnin is equally good treatment as in the preceding form.

Meat Inspection Judgment.—Carcasses of animals suffering from any of the forms of blood-poisoning are dangerous for use as food by human beings. The eating of this meat would not in itself produce blood-poisoning, but the germs contained in the meat do cause severe inflammation of the stomach and bowels, and might produce even a fatal diarrhea.

JOINT AND NAVEL ILL (INFECTIOUS ARTHRITIS)

This is a condition which results from the introduction of germs into the body through the infection of the navel in the first few days of life. These germs localize in the large joints, where

they produce severe infection, together with profound symptoms of toxic products in the blood. The disease is a very common one in calves and colts, but is comparatively uncommon in pigs. Necessarily it occurs in the first few days of life before the navel has dried up and fallen off. In some cases the infection becomes a general one, and the germs cause abscess formation in other parts of the body as well as in the joints.

Causes.—Filthy conditions in the pens where the sows are allowed to farrow is the most common cause of this condition. The fresh navel cord very easily becomes infected if allowed to drag in mud, manure, and other filth. The germs entering here are very quickly carried through the body, and set up abscesses in the joints and other spots where they lodge. In some seasons the disease appears to be particularly common, and appears in these seasons to be due to some special germ which may attack large numbers of pigs on a farm and may even spread to surrounding farms.

Symptoms.—The first symptom noted by the owner usually is the fact that the pig becomes lame. At the same time, there may be loss of desire to suckle the mother, the pig becomes feverish, is often constipated, and loses its natural activeness and playful characteristics. If an examination of the navel be made at this time it will be found to be red, inflamed, and tender. In the majority of cases there will be an abscess formed at the navel. This may rupture internally and set up a fatal peritonitis, or, more commonly, it breaks on the outside and discharges pus.

When the joints are examined they are found to be hot, tender, and swollen. If the condition is allowed to run its course untreated, these joint swellings may develop into abscesses, and these may break externally and discharge pus. In such cases the pig loses weight, loses all appetite, and becomes very much stunted, weak, and finally dies from exhaustion, and the effects of the toxic substances absorbed from the multiple abscesses are scattered throughout the body.

Treatment.—As in the case of blood-poisoning, this is a disease which is largely due to neglect, and one which can much easier be prevented than cured. Clean, dry, well-lighted, and sunshiny breeding pens will do more toward keeping this disease out of

the litter than any other single measure. If the disease makes it appearance the infected pen should be carefully cleaned and disinfected. All infected litter should be removed and burned. Other pigs should be kept out of this pen, and sows that are about to give birth to litters should be placed in pens as far removed as possible from the one in which the disease exists.

Care of Navel.—It is an excellent precaution, if the disease be present on the farm, to carefully treat the navel of every newborn pig as soon as possible after its birth. This can be done by washing the cord with a strong solution of one of the tar disinfectants, using about a 10 per cent. solution, and then applying a drying dusting-powder which contains a small amount of carbolic acid in combination with stearate of zinc, alum, and starch.

Echinacea.—In the active treatment of these cases there is no single agent as effective as echinacea. If an abscess be present at the navel it should be opened and allowed to drain. The parts can now be thoroughly washed with a strong solution of one of the disinfectants and freely bathed with a reliable preparation of echinacea or echafolta. In addition to this, give about 10 or 15 drops of the drug per mouth every three hours. To clear out the bowels give a small dose of calomel, about 1 or 1½ gr. This should be followed the next day by an ounce of castor oil. Keep the pigs warm and in a clean, dry place. As stimulants, teaspoonful doses of whisky, to which 5 drops of tincture of nux vomica are added, may be given every three hours with the echinacea. With this line of treatment carefully carried out a large percentage of the cases should be saved.

RABIES (HYDROPHOBIA)

Rabies is one of the most common of the infectious diseases in the dog, and, on account of the frequent association of dogs with live stock, rabies is often transmitted by bites of the rabid animals. This disease is one of the oldest of which we have definite medical knowledge. In addition to dogs and swine, the disease may be seen in horses, cattle, and sheep, as well as in man.

Cause.—The cause of this disease in the hog is the bite of a dog suffering from the disease. These mad dogs often get in a feed lot and bite a large number of stock before they are discovered

or pass along their way. In many cases the bites are never noticed, and the first knowledge of the fact that the herd has been visited by a rabid dog is obtained when the animals begin to show signs of the disease.

There is undoubtedly a specific germ which causes rabies, but what its exact nature is no one has ever been able to discover. This germ apparently attacks the nervous system and lodges in the brain and spinal cord. It produces a powerful poison which acts upon the general nervous system, producing the marked symptoms that characterize the disease. This germ, whatever it be, is also found in the saliva, and is in this manner carried into the tissues of the bitten animal with the bite of the teeth.

Symptoms of rabies do not begin to show themselves for two or three weeks after the hog has been attacked by the mad dog. During this time the animal shows no signs of anything wrong. The wound made by the bite apparently heals over, and it looks as if a complete recovery had been made.

All at once it is noticed that the hog is very restless. The animal runs around in all directions, grunts hoarsely, roots in the litter, may attack other hogs, their litter, the attendants, cattle, or anything that comes in its path. The wound opens up again and begins to discharge. This bite is very irritable, and the hog will scratch and attempt to gnaw at it.

In rooting in the litter it often swallows many hard, indigestible objects. These may be found in the stomach after death. The rabid hog may attempt to gnaw the boards on the sides of the pen, will often eat large amounts of earth and pieces of old rotten logs, and similar objects that may be in the feed lot.

When the sick animals lie down they may remain quiet for a considerable length of time, but the moment anyone approaches the pen they jump up and run around the pen in a wild manner. If a human being enters the lot with them they will make an attempt to attack him. Saliva runs from the mouth and is seen as a frothy foam. They attempt to drink water and eat food, but the attempts to swallow produce severe pain and they soon give it up.

Young pigs that are affected with rabies may fall on their

front knees and push themselves around in this kneeling position for several minutes or even longer.

Paralysis usually develops about the second or fourth day. The animal is now quiet. It lies in the litter and refuses to move. Death follows in a short time.

If a postmortem examination be made of a hog that has died of rabies but little information is gained. The internal organs are but little changed in appearance. In the stomach the indigestible foreign objects may be found. The spleen and liver may be slightly enlarged and discolored, but there is nothing diagnostic to be found. If the brain and cord are removed the surface of these organs may be found to be somewhat congested and watery in appearance, but there is nothing distinctive about the findings.

The only method by which a positive diagnosis can be made is to send the brain to some laboratory for examination under the microscope. With proper staining of the tissues and a powerful microscope certain diagnostic changes are seen in these tissues. There is a marked congestion of certain parts of the brain and the appearance of certain characteristic abnormal structures which are known as Negri bodies. These are so called in honor of Prof. Negri, of Italy, who first saw and described them. By some they are believed to be a form of germ which is the real cause of the disease.

Treatment.—There is absolutely no treatment of value for rabies in the hog, with the possible exception of the use of quinin in enormous doses. In highly valuable pure-bred hogs it might be worth while to try the injection of quinin in large doses, giving it by deep intramuscular injection. Extreme care must be exercised in handling the sick hog to see that the man who is giving the treatment be not attacked and bitten. The danger is so great that it would seem advisable rather to kill the hog than to attempt treatment.

Preventive treatment consists in keeping dogs, and especially stray ones, out of the feed lots. Proper muzzling of all dogs would also be a big step in the prevention of the disease, not only in hogs, but in dogs and man as well. By strict enforcement of muzzling ordinances in England rabies has been almost entirely wiped out in that country. In America, owing to the carelessness in this regard, the disease is constantly on the increase.

TUBERCULOSIS

This is a disease which has for years been on the increase in both man and the lower animals. So widespread has the disease become that it is commonly referred to as the "great white plague." The widespread distribution of this disease in our hogs was never fully realized until the present thorough system of meat inspection was put in force a few years ago. Over 25,000 head of hogs are now condemned every year on account of this condition. In addition to this, nearly 500,000 other carcasses are found slightly affected, but not sufficiently so as to warrant condemning the entire carcass.

Fig. 79.—Hogs eating droppings from tuberculous dairy cattle; a common cause of tuberculosis in hogs (B. A. I. Circular No. 201).

Causes.—The active cause of tuberculosis is a specific germ, known as the tubercle bacillus. This little germ is a very small, microscopic body, which enters with the food and drink of the hog or through the inspired air, and, locating in some favorable spot, sets up a diseased condition, which may remain local at that point or may spread throughout the entire body.

This germ reaches the body of the hog almost always through the food. The most common foods with which the germ enters being feces from tuberculous cattle and milk from cows that are suffering from the disease. In cattle with tuberculosis of the lungs, when they cough and raise the tuberculous sputum from the lungs,

instead of spitting it out, as in the case of human beings, the sputum is swallowed and passes out with the feces. In this way the feces of tuberculous cattle becomes a very productive source of tuberculosis infection in hogs. In dairy districts a large percentage of cows are often tuberculous, and as it is the usual custom to allow hogs to follow the cattle in the same feed lot, tuberculosis of the hogs is bound to follow.

Another very common means of carrying the disease to the hog is through milk. Milk from dairy farms, or from any cow, for that matter, may contain large numbers of tubercle germs. In the creamery districts the milk from an entire community is

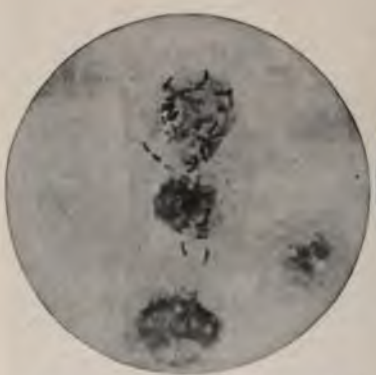

Fig. 80.—Bacillus tuberculosis, human, in pus from lung. Zettnow prep. (Kolle and Wassermann).

Fig. 81.—Bacillus tuberculosis, bovine, in a section of the peritoneum (Fränkel and Pfeiffer).

hauled to the creamery, the cream separated out, and the skimmed milk run into a large vat. From this vat each farmer draws off his share and takes it back home to feed to his hogs. Now, if any of the milk brought to this creamery is from tuberculous cows, and in almost every case there is bound to be some of it that does come from cows suffering with the disease, the germs are scattered through the entire skimmed-milk tank, and are carried in this manner to every farm that sends milk to the establishment. It is for this reason that such large numbers of swine coming from the dairy districts are affected with the disease.

Tuberculosis is predisposed to by insanitary conditions in

the feed lots. Filthy, manure-covered feed lots, mud-holes, dirty hog wallows, and similar unhygienic surroundings make the hog more susceptible to the action of the germs and increase the chances for infection by breathing in tubercle bacilli with dust and dirt in the air.

Improper sleeping quarters, and especially allowing hogs to sleep around a straw or manure pile, increase the chances for tubercular infection. The overheating that results lowers the

Fig. 82.—Viscera inspection of hog carcasses by U. S. Government inspectors. All important organs and glands are carefully examined for evidences of tuberculosis, hog-cholera, and other diseases (U. S. Bureau of Animal Industry Report).

vitality of the animal, chronic irritation of the lung is set up, and the tubercle bacillus finds a very suitable field in which to develop if it gains entrance.

Symptoms.—Tuberculosis may, and often does, exist in swine without producing any visible symptoms whatever. The disease is one that develops slowly, and it takes many months for it to make itself plainly evident. It is for this reason that tuberculosis exists in such large numbers of hogs without its presence even being suspected. It is also largely on account of the fact that the

disease causes such slight manifestations that owners of swine are so negligent in attempting to check the spread of tuberculosis among swine. At the packing houses some of the most marked cases of the disease are seen in hogs that are large, fat, and apparently in the very best of condition. In fact, it seems that during the first few weeks or months of the disease the presence of the toxic substances produced by the germs act as a bitter tonic to the system of the hog and cause it to thrive particularly well.

In those cases where evidences of the disease are noticeable, they consist principally of a general appearance of unthriftiness. This is a symptom of a number of diseases, and does not mean very much from a diagnostic standpoint. If the disease advances rapidly and becomes generalized, more marked symptoms may appear. In those cases that involve principally the abdominal cavity the symptoms will show loss of appetite, digestive disturbance, constipation, and diarrhea. Persistent coughing of a harsh, dry character is the most prominent symptom of a tuberculous infection of the lungs. Cough in hogs that are kept in improper surroundings, and especially with overheating and overcrowding at night, is not uncommon, and may or may not mean tuberculosis. Infestation of the lungs with the lung worm also produces a harsh, dry cough, and the condition so developed cannot be reasonably distinguished from tuberculosis.

Where the disease becomes well generalized, and affects both the lungs and the digestive organs, more marked suggestive symptoms may develop. In addition to the cough and interference with respiration and the digestive disturbances there is noted a loss of weight and energy. The hog so affected does not do well and begins to loose its usual vigor and activity. It eats poorly, may have alternating periods of diarrhea and constipation, and becomes easily exhausted. Such cases as these can be sometimes diagnosed with a fair degree of certainty as tuberculosis. Such plainly marked cases are, however, very unusual, and even the most expert can seldom make a diagnosis of the disease in the living hog except by the use of a special diagnostic method, known as the tuberculin test. This tuberculin test has been extensively used in cattle and in man with most pleasing results. In the hog it is not quite so dependable, especially when given by the subcutaneous method.

ner of giving the tuberculin test has been devised. This consists in shaving the hair off of a small area on the skin and injecting a drop or two of the test fluid between the layers of the skin. *Not under the skin.* The animal is then left undisturbed for twelve to twenty-four hours and the spot then examined. If a positive reaction is obtained, the area surrounding the point of injection will be found to be reddened and inflamed. In an animal which has no tuberculosis the spot will be natural in color, and no change will

Fig. 83.—Head inspection of hog carcasses. Over 95 per cent. of cases of tuberculosis of hogs show the disease in the glands of the head and neck (U. S. Bureau of Animal Industry Report, No. 201).

be seen as a result of the action of the tuberculin. This is what is known as the intradermal method. It is very simple as compared with the subcutaneous method, and in the hands of a competent man is more reliable in the case of hogs.

Postmortem Lesions.—When a tuberculous animal is opened up after death certain very characteristic pathologic changes or lesions are found. There are certain places in the body where these lesions are particularly frequent, and in making an examination for tuber-

culosis these particular parts should be examined. The favorite locations for tuberculous lesions in the hog are in the digestive tract.

Fig. 84.—Tuberculosis of pleura, ribs, and bones—generalized case. (From U. S. Bureau of Animal Industry Circular, No. 201.)

At the angle of the jaw there is located a prominent lymph-gland, known as the submaxillary lymph-gland. This structure receives

the drainage from the floor of the mouth, and, accordingly, readily becomes infected if food-carrying tubercle bacilli be eaten. In hogs this is the most common site for development of tuberculosis. Nearly 90 per cent. of cases of tuberculosis in the hog show involvement of this gland. In meat inspection work this is the first part of the body that is examined.

Next in frequency comes the glands located in the ruffle fat of the intestines. These glands receive the drainage from the intestines, and when tuberculous milk or feces enter the bowel it is only a short time until tuberculosis of these glands takes place. The liver and spleen, together with their lymph-glands, are next in frequency. Tubercles in the liver, if less than twelve in number, may be the result of drainage of the intestines by the portal vein, which carries blood from the bowel to the liver. If more than twelve spots are seen it is good evidence that the disease is generalized, and the carcass should not be eaten for food. Tuberculosis of the spleen can only occur when tubercle bacilli enter the blood in considerable numbers, and this means that they are likely to be scattered in the muscular tissues all over the body. The tuberculosis of swine is capable of producing this same disease in man, and for this reason every hog carcass intended for use as human food should be carefully inspected.

In well-generalized cases tubercles may be found in the kidneys, the testicles of male animals, the ovaries in the female, or even in the muscles themselves.

Tuberculosis of the lungs is not quite so common in the hog as in cattle. However, the disease often is carried through the blood or through the lymph until it finally reaches the thoracic cavity, and then sets up tuberculosis of the lungs and of the lining membrane of the chest—the pleura. In very severe cases the lining membrane of the belly cavity may also be found to be tuberculous. This form of the disease is known as tuberculous peritonitis.

Tuberculosis in all these regions appears very much the same. The typical lesion is a white, translucent, rounded body, which projects like a little bump above the surface of the organ. When this is cut into it is found to have a more or less cheesy appearance. These nodules or tubercles vary in size from that of a millet seed to as large as an orange.

Treatment.—There is no treatment for tuberculosis that is worth considering except the measures for prevention of the disease.

Fig. 85.—Tuberculosis of intestines, liver, spleen, and peritoneum of hog. (From U. S. Bureau of Animal Industry Circular, No. 201.)

Prevention of tuberculosis in hogs consists almost entirely in taking proper steps to eradicate the disease in cattle. All dairy herds

should be tuberculin tested, and those that react should be removed from the herd or at least removed from the feed lots where hogs are also kept. All skimmed milk from creameries should be sterilized by heating before being returned to the farms for feeding to hogs. Kitchen refuse, which often contains sputum from tuberculous human beings, should not be used as an article of food for hogs.

Further steps for the prevention of the disease consist in thorough attention to the sanitary conditions of the feed lot and sleeping quarters. Clean, dry feed lots, light, airy, well-ventilated and sunshiny sleeping pens are important essentials in preventing the occurrence of swine tuberculosis. In introducing new breeding stock it is a wise precaution to require a tuberculin test of the new animals in order to make certain that they are free from the disease. With the intradermal method of making the test this is a very simple procedure, and one that should not be neglected.

DISEASES OF DIGESTIVE TRACT

SORE MOUTH (STOMATITIS)

STOMATITIS is an inflammation of the mucous membrane lining the mouth. It may involve only a part of the cavity, or the entire lining of the mouth may be red and inflamed, and the mucous covering of the tongue is also usually affected.

The disease is very common in the hog, but often escapes notice, and, as the course is usually mild, treatment is often neglected. Stomatitis is also a common disease in other domestic animals, especially horses and cattle.

Sore mouth may be a primary disease or it may be a secondary complication in the course of some other disease.

Causes of Primary Stomatitis.—As a primary disease, stomatitis, or sore mouth, may occur as the result of injury from sharp-pointed foreign bodies, such as pieces of wood, thorny plants, weed stubbles, and various other irritating substances. Not infrequently one of these sharp points becomes lodged in the mucous membrane lining the mouth, and, as a result, sets up an infection and inflammation. Small pieces of bone, nails, and sharp pieces of gravel or coal are occasionally met with as the cause of the disease. Bearded grains of barley or wheat, or the beards from barley or wheat straw, may be the cause of the disease in some cases.

In the handling of hogs for purposes of ringing or castrating, where a looped rope or wire is used to hold them by snaring the loop in the mouth, the rough handling and rubbing of the rope on the lining of the mouth may set up an inflammation. In sick animals, powerful drugs, such as ammonia, are sometimes administered in strong solution, and prove sufficiently irritating to set up an inflammation.

Where sour distillery slops are used as an article of daily food for the herd this disease often breaks out. The cause in these cases is the formation of an irritating chemical substance in the

soured slop, which irritates the mucous membrane and produces a stomatitis. In these cases it is usually associated with disease of the stomach and bowels produced by the same irritating toxic substances.

Inflammation of the mouth may result from burning of the mouth by eating food which is too hot. Where ground foods are cooked and fed hot, care must be used not to have them too warm at time of feeding. Stomatitis may also occur as the result of combining irritating drugs with the food, such as lye or copperas. These agents are frequently given on the farms for the purpose of ridding the animals of worms which are believed to be present. The results are often very disastrous.

Another not infrequent cause of stomatitis, or sore mouth, is the careless handling of disinfectant solutions about the barnyard. Often where solutions of carbolic acid or corrosive sublimate are handled, they are carelessly spilled on the ground after being used. If a hog is present in the barnyard he will invariably come and wallow in the artificial mud-hole made by the bucket of disinfectant solution. He will also usually drink a certain amount of the fluid, and not infrequently will have, as a result, a sore mouth for several days. In some cases the results are even more severe, and an inflammation of the stomach and bowels may be the result.

Hogs which are allowed to run in filthy wallows frequently develop a sore mouth as a result of the poisonous molds and germs developed in the stagnant waters. Another source of danger in these hog wallows is drainage from old manure piles. The seepage from these manure piles contain a large amount of ammonia and other irritating substances, and hogs that are allowed to drink water from a wallow which receives drainage of this kind are always likely to develop a sore mouth and even more severe infections of the stomach and bowels.

Decomposing and rotten food is another source of chemical irritants that often set up a stomatitis. Milk of animals that have diseased udders is commonly fed to hogs. This milk is just as dangerous to the hog as it is to the human being. The germs present are likely to cause stomatitis, or disease of the stomach, with vomiting and diarrhea. Molded silage, poisonous weeds,

and certain grasses and clover often cause inflammation of the mouth. Caterpillars and plant lice often get into the mouth with the food and cause trouble.

Secondary Stomatitis.—Sore mouth often develops as a secdary condition or complication in hog-cholera, pneumonia, anthrax, and in severe infections of the stomach and bowels.

Symptoms.—The disease is rather mild in character, and may often pass almost unnoticed. The lining of the mouth first becomes hot and dry and there is a checking of the flow of saliva for a few hours. The mouth is quite sore and tender, and the animal eats food very sparingly or not at all. Especially is he prone to refuse any hard food, such as ear corn. The pain of eating is too great, and he would sooner go hungry than eat. If the mouth is examined at this time it will be found to be hot, dry, very red, and quite tender.

The second stage follows in a few hours, in which the dryness of the mouth is replaced by a profuse flow of saliva. The mouth is filled with secretion, and the saliva drools from the sides of the mouth and even hangs down from the jowls in long strings or shreds. The mouth is still hot and painful, and there is a decidedly bad odor, due to the decomposition of saliva and débris in the mouth. The animal refuses all forms of hard food, and eats very slowly and carefully even when eating soft foods. Thirst is usually a marked symptom at this stage of the disease.

If the condition be very severe there may be sloughing of the lining of the cheeks in spots, with the formation of small, shallow ulcers.

Course of the Disease.—This is usually short and comparatively mild. Most cases recover in a few days at most, even without treatment. Some cases, especially those due to improper feeding, may last for weeks, and the animal may lose flesh and become stunted.

Treatment—The treatment of stomatitis, or sore mouth, is divided into the prevention and cure of the disease.

Preventive.—Prevention of stomatitis consists in care as to nature of food given. Avoid use of sour distillery slops, dirty milk, lyes, copperas, and soap, which are common in kitchen refuse, and the use of bearded grains, such as wheat and barley. Filthy

hog wallows should be drained out and replaced by modern concrete wallows which can be kept clean. In giving drugs by mouth use care not to have them in too strong solutions. When handling hogs with a rope use care not to allow the rope to produce too much rubbing and irritation.

Curative.—The mouth should be examined, to see if there is any foreign body, such as a splinter of wood or a piece of wheat or barley straw, embedded in the mucous membrane. If such an irritant be found it should be removed. The next important thing in the treatment of these cases is to give them plenty of fresh cold water in which to plunge the inflamed mouth to cool and wash it. To this water we may advantageously add chlorate of potash in the dose of 2 or 3 tablespoonfuls to the pail of water. Stronger solution, of a tablespoonful to the pint of water, may be used to wash out the mouth in severe cases. A favorite domestic remedy and a very effective one, too, is made by taking 1 quart of water, 4 ounces of vinegar, and 1 tablespoonful of common salt, mixing together, and using for a mouth-wash.

Boric acid solutions, solutions of creolin, solutions of alum, and simular substances are sometimes used. The cold water and the chlorate of potash are about all that will be required in the majority of cases.

A very important essential, of course, is to find out if the disease be due to the feeding of any particular class of food, and, if so, make such change in the diet as will remove this cause. During the course of the disease the food given should be of a soft, easily digested character. Bran, middlings, and milk make a good combination during the acute stages of the disease.

PTYALISM (SALIVATION OR SLOBBERING)

This is a condition somewhat similar to the one just described. It consists principally in an overactivity of the salivary glands and an overproduction of saliva. It may be caused by irritation of the mouth or of the salivary glands. It is often due to the eating of mercury or lead. The principal symptom is an excessive flow of saliva, with drooling of the fluid from the mouth in large quantities.

Treatment.—This is about the same as for sore mouth. The main thing in treating ptyalism is to discover, if possible, the cause and remove it. Frequently this condition is due to pasturing the animals on Swedish clover. Removal from these pastures is frequently all that is necessary. Plenty of good cold water, with the addition of a little chlorate of potash, is about all that is usually required in the way of medicinal treatment. In severe cases small doses of atropin or belladonna may be given. Atropin and belladonna are poisonous drugs, and should only be given by a veterinarian who fully understands their powerful character and possibility of harm from overdose.

PAROTITIS (INFLAMMATION OF PAROTID GLAND)

The parotid gland is a large organ located just in front of and below the ear along the side of the jowl. It is one of the glands that secretes the saliva, and is often the seat of inflammation. In human beings there is a special type of infectious parotitis which is known commonly by the name of the *mumps*.

Causes.—The causes for inflammation of the parotid gland in the hog are usually some form of injury. In handling the animals for the purpose of ringing or castrating, where the stanchion chutes are used, the head may frequently be so bruised as to cause an inflammation of this gland. In fighting with other animals the gland may be injured. Likewise by getting the head fast in an opening in the fence, or in trying to get through a gate, the animal may injure the parotid gland and a few days later have a severe inflammation of the gland.

In not a few cases the disease is due to the spreading of an inflammation from the mouth. In stomatitis the inflammation not infrequently travels up along the tube which leads from the mouth to the gland and causes a secondary inflammation of the parotid gland.

Symptoms.—The symptoms of parotitis are principally pain, swelling below and in front of the ear, and marked local tenderness. The swelling often becomes quite large, and the jaws are often opened with difficulty. The pain on moving the jaws becomes so marked that the animal is liable to eat very little on account of the distress caused by the chewing movements.

When examined, the outline of the swollen gland can be easily made out. The swelling is quite hot and very painful to the touch. In some cases the swelling becomes soft and boggy, and may break externally, with a free discharge of pus.

Course.—As a rule, the condition lasts but a few days and gradually passes away. In those cases where an abscess forms and breaks externally, with the discharge of pus, the condition may last for several days, or even weeks, before it entirely clears up. In these cases there may be considerable loss of weight and unthriftiness, due to inability to eat properly.

Treatment.—Very little treatment is required, as a rule. In severe cases local applications may be made of cold water or of cloths wrung out of cold water. Tincture of iodin, applied over the swelling, is also an efficient method of treatment. Mercury ointment or, as it is commonly known, blue ointment, is also an efficient local application. Phytolacca and aconite are the best remedies for internal use.

The mouth should be examined to determine if there is anything located there which is causing the trouble. Soft food for a few days, plenty of water to drink, and perhaps a light purge with castor oil are all effective in inducing comfort and hastening recovery.

In those cases where pus forms, and an abscess is certain to follow, the abscess should be opened surgically, a free incision being made to allow the escape of the pus. The cavity should then be swabbed out with tincture of iodin.

PHARYNGITIS (INFLAMMATION OF THE PHARYNX, SORE THROAT)

The pharynx is that part of the digestive tract which connects the mouth with the esophagus or gullet. It lies immediately back of the base of the tongue, and is frequently the seat of inflammation. In disease of the pharynx the tonsils are also commonly affected. Both the tonsil and the pharynx are commonly the seat of disease in the hog. This condition exists much more frequently in the hog than is commonly known, and is often neglected.

Causes.—There are a great number of causes for inflammation of the pharynx, among which may be mentioned irritating foods,

exposure to cold, inflammation of the mouth, swallowing of sharp-pointed substances which scratch or injure the lining of the pharynx, and the inhalation of irritating gases. The disease commonly follows stomatitis, and also commonly occurs in company with laryngitis, which is described under Diseases of the Respiratory Tract.

Symptoms.—Among the first symptoms to be noted of pharyngitis is the fact that the animal takes food rather slowly and in very small amounts. Especially will this be true with the hard foods, such as corn. The animal has the appetite, but the difficulty lies in inability to swallow. The pharynx by this time has become so tender, painful, and swollen that it is almost impossible for the animal to swallow anything but liquids. As an example of the great difficulty experienced in trying to swallow, the animal will often take food into the mouth, chew it up, and then throw it out of the mouth again, so painful is the attempt at swallowing.

The head and neck are held out stiffly, and when the animal walks or moves about it holds the neck in a very stiff manner. There is a considerable amount of swelling about the throat and any movement of the head or neck is painful. The swallowing even of water is quite difficult, and, as a result, the animal not only refuses food, but also drinks but little water. The snout may be placed in the water trough, and the mouth washed in the water, but very little will be swallowed, as every attempt at swallowing is accompanied by the most severe pain.

The animals are usually restless, and may squeal and grunt considerable in evidence of the pain which they are suffering. Swallowing movements are made very frequently, due to the irritation of the lining of the throat. Mucus collects in the mouth and there may be considerable discharge of saliva from the jaws. The eyes often appear red and watery. In some cases vomiting may occur.

In practically every case there is an associated inflammation of the nose and larynx. This results in a discharge from the nose and a pronounced cough. This cough is usually worse if the animal comes out of a warm shed into the cold air.

When the animal is caught, and an examination of the neck and

throat made, it will be found to be quite severely swollen and very painful and tender. The lining membrane of the mouth and throat is of a purplish-red color and there is a decidedly bad odor from the mouth.

As the condition becomes worse there is often regurgitation of food through the nostrils, difficulty in breathing, and a whistling or snorting sound at each breath. There is usually considerable fever present. Abscesses or ulcers may form in the throat, and these, with the swelling already present, not infrequently shut off the air-passages and cause death.

The bowels are usually constipated, and the animal loses flesh and strength as a result of the inability to properly take food and drink.

Treatment.—Prevention of this disease consists in avoiding the causes for producing inflammation of the digestive and respiratory tract. Proper quarters, proper ventilation, and proper non-irritating foods are the principal factors in prevention of the disease.

In the medicinal treatment of the disease the first thing to be done is to place the animal in comfortable warm quarters, which are properly ventilated and open to sunlight if possible. The animal should be given plenty of good clean water to drink and food of a soft character. This food should preferably be warmed, especially in winter time. Milk is perhaps the best diet.

As a preliminary to other methods of treatment it is a good plan to give a cathartic, consisting of calomel and castor oil. This should be followed by small doses of aconite and belladonna. The aconite and belladonna may be well given in the form of an electuary, made up to contain 3 ounces of syrup, 2 drams of tincture of aconite, 1 dram of tincture of belladonna, and 2 drams of potassium chlorate. One-half to one teaspoonful of this may be placed in the mouth every three hours. It reduces the fever, overcomes the congestion, relieves the pain, and has a most beneficial effect on the general condition.

As a method of local treatment in severe cases it may be desirable to swab out the throat with a solution of nitrate of silver, using 1 part of the drug to 100 parts of water. A swab should be fixed up with a wire handle, and the hog held by means of a

noose slipped over the upper jaw. It has been my observation that just about as much harm is done by the use of these local applications as there is good.

A stimulating liniment containing camphor, ammonia, and cotton-seed or sweet oil may be used with advantage over the throat. The ordinary camphorated oil, as bought at the drug stores, is an efficient remedy for use in this manner.

Chlorate of potash added to the drinking-water, 2 to 3 tablespoonfuls to the bucketful of water, will add to the comfort of the animal and hasten recovery. In case abscesses form, they should be opened and drained.

Some cases of sore throat show a tendency to become chronic in character. In these cases a great amount of benefit can be obtained by the application of a blistering ointment containing 1 dram of powdered cantharides in 1 ounce of vaselin. Another very efficient blistering ointment can be made, containing 2 drams of biniodid of mercury in 1 ounce of vaselin. Tincture of iodin is another effective external application in either the acute or chronic stages of the disease.

In valuable animals, where death threatens from suffocation, it may be desirable to have a tube inserted in the windpipe or trachea. This operation is best performed by a skilled veterinarian, and is hardly an operation to be attempted by a layman.

ESOPHAGITIS (INFLAMMATION OF THE ESOPHAGUS)

The esophagus or gullet is the tube which leads from the pharynx to the stomach. It carries the food from the mouth to the stomach, and is sometimes referred to as the food-pipe. The gullet may be the seat of inflammation arising from much the same causes as those just described for stomatitis and pharyngitis.

Causes.—Among the more common causes for esophagitis, or inflammation of the gullet, are the eating of foods while they are very hot, or the swallowing of irritating chemical substances, such as solutions of carbolic acid or bichlorid of mercury. Eating of wheat and barley straw and other rough, irritating foods may also result in an inflammation of the food-pipe.

In many cases the disease is due to an extension of an inflammation from the mouth and pharynx. The disease may follow

down the gullet, and finally involve the stomach and bowels as well.

Inflammation of the esophagus, or gullet, is not as common as inflammation of the mouth or pharynx, because the irritating foods pass through the gullet more rapidly, and do not remain long in contact with its lining membrane. The inner coat of the esophagus does not contain much glandular tissue, and this also prevents to a certain extent infection in this part of the digestive tube, as there is less opportunity for the germs of disease to get a foothold.

In the majority of cases this disease will be seen as a result of taking some irritating poison, such as carbolic acid, strong solutions of lye, bichlorid of mercury, or the eating of distillers' slop while very hot.

Symptoms.—In many instances a mild case of inflammation of the gullet may pass unnoticed. In the more severe cases the symptoms in many respects resemble those of an inflammation of the pharynx, and, in point of actual fact, the two conditions are associated in the majority of cases. The same causes that would produce an esophagitis would also cause a pharyngitis in the greater percentage of cases.

The principal symptoms noted in an acute case are difficulty in swallowing, fixed position of the head and neck, some degree of swelling along the neck, local pain and tenderness, and refusal of food, owing to the great amount of difficulty in swallowing.

Course.—The course of the disease is usually fairly short. In simple acute cases the condition will clear up in from one to two weeks, often without any treatment. In some of the severe cases, due to acid burns, there may follow a narrowing of the gullet which will make it difficult or even impossible for the animal to swallow anything but liquid foods. In these cases the animal never recovers, and unless early sent to slaughter the hog becomes stunted and worthless.

Treatment.—Preventive treatment consists entirely in careful feeding, to avoid the giving of any irritating substances which might cause inflammation of the food passages. Especially is it necessary to use caution in disposing of strong disinfectant solutions. These must not be emptied out in the feed lots where they may be taken up by the swine.

Active treatment consists in giving plenty of cold water to drink. To this may be added chlorate of potash or a little saltpeter. Milk is also agreeable. Mucilaginous drinks, such as an infusion of linseed, has a very soothing effect upon the inflamed mucous membrane. Little or no other medical treatment is necessary. In some few cases where the pain becomes quite severe small doses of opium may be given.

The diet should, of course, be of a light, soft, and semisolid nature. Bran in the form of a mash with milk or other suitable slop forms a good, nourishing diet, and is easily swallowed if the inflammation be not too severe.

In those cases where there is deep destruction of the tissue of the gullet and scar-tissue forms, which contracts down and narrows the caliber of the organ so as to cause permanent difficulty of swallowing, the only course open is to advise early sale and slaughter of the animal. No practical method of treatment can be advised, and the longer the animal remains on the premises, the less he will be worth.

OBSTRUCTION OF ESOPHAGUS (CHOKE)

Obstruction of the esophagus is simply what the name implies—closing up of the esophagus by some foreign body. It is quite a common condition in all the domestic animals, but is especially frequent in cattle and swine.

Causes.—The causes of obstruction of the esophagus in swine are most frequently swallowing of some hard substance which is of such size that it will not pass through the gullet or food-pipe. Among the more frequent articles of this kind are pieces of potato, apples, or leaves.

The stoppage may be complete, in which case not even fluids can pass by the obstruction; or it may be only partial, in which case water or other liquids can pass by the foreign body, but solid substances are unable to pass. The complete obstruction is the more frequently found.

Symptoms.—The animal when seized with "choke" suddenly stops eating, and begins to gag, or choke, as it is commonly called. The pain causes considerable restlessness, and repeated efforts are made to swallow. The animal usually stands with the head

[illegible] and the nose nearly to the ground. There is con-[illegible] coughing, gagging, and there may even be vomiting. [illegible] makes repeated efforts to swallow. The hog suffering [illegible] will try again to eat and drink, but the food is unable [illegible] obstruction in the gullet, and is returned either [illegible] mouth or the nose.

[illegible] may be only temporary, and by the continued [illegible] swallowing and gagging the foreign body may be finally [illegible] into the stomach or forced back through the gullet [illegible] mouth. In this way a large number of choke cases relieve [illegible]

[illegible] the choke remains permanent until removed by [illegible] owner or a veterinarian. In these continued cases the [illegible] stands around with the head down, mouth open, and [illegible] coming from the mouth. The animal is continually [illegible] efforts to swallow, frequently gags, and makes efforts as if [illegible] irritation of the air-passages causes the animal fre-[illegible] fit of coughing. If the obstruction be in the [illegible] the hog makes a peculiar yelping sound, quite [illegible] Any effort at drinking water causes the [illegible] through the nose and mouth.

[illegible] the animal is good and he is really hungry. As [illegible] will be made to eat. The food is taken into the [illegible] but attempts to swallow are followed by a fit [illegible] and the food is thrown out either by way of the mouth [illegible] the nose.

[illegible] cases there is considerable swelling, and the pressure [illegible] the nearby air-tubes causes a great amount of difficulty in breathing, and in very severe cases may cause death by shutting off [illegible] air to the lungs. In other cases food passes down the air-tubes instead of the food passages, and results later on in a mechanical pneumonia, which ends the life of the animal.

If the animal is caught, and a careful examination made of the neck and throat, it is often possible to feel the apple, potato, or other foreign body which is causing the trouble. This is possible only when the difficulty is located in the upper part of the gullet. If the blocking is lower down near the stomach it is impossible to feel it by external examination.

Course.—As has already been stated, in many cases the animal, by repeated efforts at swallowing, gagging, and vomiting, may dislodge the obstruction and relieve itself. In these cases the intruding substance may be forced on into the stomach or it may be regurgitated into the mouth. In either case relief immediately occurs.

In the more severe cases the body can only be removed by outside interference. In these cases, unless the animal gets help in a few hours general effects of the condition will be seen. The foreign agent may by pressure close off the trachea or wind-pipe, and in this manner produce death. If left for several days, the animal will show loss of flesh and a general run-down condition. In other cases a pneumonia develops from the passage of food down into the lungs. Loss of sleep and continued restlessness increases the effects upon the animal. In case of complete closure of the tube the animal will die in a few days from want of water and food.

Many cases that go untreated result in a slough and gangrene of the gullet, and the infection then spreads to the surrounding tissues of the neck and the animal soon dies from a general infection.

Diagnosis of choke should not be difficult. There is no other common condition in the hog that shows the same train of symptoms. History of sudden onset, the characteristic position of the animal, with head down, mouth open, and saliva running from the mouth, is very suggestive. This, in connection with the repeated efforts at swallowing, gagging, and attempts to vomit, make the picture quite clear. In those cases where the obstruction is located in the upper part of the neck the diagnosis can be made absolutely certain by examination and feeling of the obstructing body.

Treatment.—The method of treatment of choke will differ somewhat, depending on whether the obstruction is in the upper or lower part of the gullet.

If the obstruction is located in the upper portion of the gullet it may often be removed by placing a mouth-gag in the mouth, and, by pressure below the point of obstruction, prevent the forcing down of the foreign body. It may now be reached by a hand inserted in the mouth and passed back through the pharynx, or

it may be reached and removed by a long forceps. The class of cases suitable for this method of removal will not be very many.

In cases where the foreign body is located further down in the gullet there are a number of procedures that may be made use of. One favorite method is the administration of oil. The oil, when poured into the gullet, has a tendency to work its way around the mass, lubricating it, and contraction of the walls of the gullet facilitates its passage down into the stomach. The administration of the oil is well followed by the use of gentle massage over the obstructing mass.

Some men favor the administration of an emetic or, in other words, something to produce vomiting. Apomorphin is the best agent to use for this purpose. Apomorphin should be given by means of a hypodermic needle, the dose being about ½ gr. By administering the oil first, and then giving the apomorphin later, if needed, the best results can be obtained, as the oil lubricates the esophagus above the foreign body and makes it easier for it to be forced upward.

In the larger animals, as the horse and cow, choke is very commonly treated by means of a probe or probang, as it is called. This is a long curved instrument, which is forced down the gullet with the idea of pushing the foreign body down into the stomach. A probang can be improvised from a flexible whip handle wrapped with muslin, or a piece of heavy rope greased with vaselin or tallow may be used. When using the metal probang great care and gentleness are necessary to prevent doing harm to the esophagus. It must be remembered that the organ is already swollen and softened, and rough handling is almost sure to result in pushing or tearing a hole through the gullet. If this is done, death is sure to follow. It is doubtful if the use of the probang should ever be attempted by one who has not had experience with its use, and it is better in these cases to call an experienced veterinarian.

PARALYSIS OF PHARYNX AND ESOPHAGUS

Paralysis of the pharynx or of the esophagus may sometimes be seen in the hog as well as other domestic animals. The condition is a result of injury to the nerves supplying the muscles of these parts. The results are about the same in either case,

the more prominent symptoms being inability to swallow, regurgitation of food and liquids through the mouth and nose, and profuse flow of saliva from the mouth.

In the case of pure-bred animals treatment of the condition may be considered advisable. In such cases strychnin is the remedy which will show the best results. It may be given hypodermically, in dose of about $\frac{1}{30}$ gr., three times a day. This is about the only remedy that will show any good effects in paralysis, and it often fails. In ordinary animals the proper course is to advise slaughter while the animal is still in good condition. This will prevent any very marked financial loss.

NARROWING OF ESOPHAGUS (STRICTURE OF ESOPHAGUS)

Narrowing or stricture of the esophagus may occur as a result of burning of the organ by some irritating poison, or by the healing of a wound inflicted by some sharp object which has been swallowed.

The symptoms of narrowing of the esophagus are difficulty in swallowing, loss of appetite, decrease in weight, and loss of strength.

Treatment of narrowing of the gullet is unsatisfactory, and unless the hog be a very valuable one it is the better policy to sell the animal for slaughter while still in good condition.

DEPRAVED APPETITE

By depraved appetite is meant a condition where the animal shows a craving for substances that would not ordinarily be taken as food, for instance, dirt, sand, rotten wood, and other like indigestible substances. The disease is not very common or important in hogs. It is sometimes seen as a symptom in other diseases, such as gastritis, chronic indigestion, and even in hog-cholera, especially of the chronic type. Another important cause for depraved appetite is feeding of hogs with an improperly balanced ration, especially one deficient in alkaline or earthy salts. Lack of exercise and nervous conditions are also sometimes noted as a cause of the disease.

Symptoms.—The principal symptom is the change noted in appetite. Frequently all desire for the usual articles of diet is lost, and the animal will leave good, wholesome food untouched in the

trough in order to eat indigestible substances, such as earth, dried feces, sand, wood, etc. The animals are also frequently quite nervous, irritable, and quarrelsome, and may attack each other. As a result the members of the herd frequently kill one of their own number and eat the carcass.

Owing to loss of appetite for wholesome food the animals begin to lose flesh, and become thin, weak, and unthrifty in appearance. It is a very common occurrence for sows suffering from this condition to eat their young pigs.

Treatment.—Prevention is the main thing in this disease. Use judgment in selecting the food supply for the herd, and give a properly balanced ration which will not be deficient in any of the elements necessary for proper growth and development of the body.

When the condition is present the principal thing in treatment is to determine the underlying disease which is the cause of the depraved appetite and treat this disease. It will usually be found that attention to the stomach and bowels, with a proper change in diet, will accomplish the desired results.

Feeding of charcoal, wood-ashes, salt, and like substances will temporarily supply the body wants and aid in hastening a return to normal.

Sows that have developed the habit of killing and eating their pigs are unprofitable from a breeding standpoint, and should be fattened and sent to market.

It should not be overlooked that depraved appetite in a herd is a danger signal that the digestive tract is out of order, and it must be remembered that this leaves the herd open to an attack of cholera. The animals should be carefully watched, and at the first signs of approach of danger the serum or serum-simultaneous method of treatment should be given. Depraved appetite in itself is not dangerous, but it is a warning of a far greater danger that must not be neglected.

ACUTE GASTRITIS (INFLAMMATION OF STOMACH, CATARRH OF STOMACH, OR ACUTE INDIGESTION)

Definition.—Acute gastritis is an acute inflammation of the stomach due to some form of irritation, as by improper food or from the action of chemical poisons.

Causes.—Acute gastritis is usually due to some error in manner of feeding or to improper quality of food given. Irregular feeding is an especially common cause for inflammation of stomach in the hog. The pig is naturally a greedy animal, and will bolt his food more rapidly than is for the best interests of the stomach. This habit is made much more pronounced if the animal is fed at irregular intervals. As a result of the irregular time of feeding the hog becomes very hungry, and when food is offered he will attack it greedily and engorge the stomach with a large amount of improperly masticated food.

In his haste to fill the stomach as quickly as possible little or no time is taken to properly chew the food, and, as a result, we have the stomach overloaded with a mass of dry, rough grain, which scratches and irritates the lining membrane and sets up an inflammation.

Another bad effect which follows irregular time of feeding hogs is loss of regular action on the part of the stomach. When the stomach does not receive food at regular times it simply loses the habit of properly digesting food, and the grain or other material taken into the stomach lies there unacted upon and undergoes souring, with the result that the walls of the stomach become inflamed.

Next to irregularity in feeding, supplying improper foods heads the list of abuses for gastritis. There is no other animal in the world that is subject to so large an amount of improper feeding as the poor hog. This animal is made the scavenger of the farm, and is required to clean up the waste that the other animals on the place will not touch. Kitchen garbage, decomposed and molded grain, rotten apples, frozen potatoes, and every other form of improper food is given to the hog, and he is expected to clean up this waste and thrive upon it. The pig is fortunately provided with a most powerful stomach, which he has developed as a result of ages of abuse, as without it he would certainly be unable to withstand conditions under which he is forced to live.

Food which is too hot, such as hot distillers' mash, and food that is too cold, such as frozen potators or apples and ice-cold water, all have a bad effect upon the stomach, and are likely to set up inflammation. Filthy, dirty foods, such as restaurant and

kitchen slops and impure water, are also important causes of the disease. These kitchen and restaurant slops also frequently contain a considerable amount of strong lye, soaps, or washing compounds which carry large amounts of caustic soda. It is only natural that these irritating drugs should cause an inflammation of the stomach. In many cases the drugs are present in such amounts as to produce death from severe gastritis.

Drinking of water which contains strong disinfectant solutions, such as carbolic acid or salts of mercury, may also produce an acute attack of inflammation of the stomach. This is a danger which has already been pointed out under the head of Inflammations of the Mouth.

A common cause of gastritis is the feeding of an improperly balanced ration of food. Especially is this likely to occur in those cases where hogs are fed on an exclusive corn diet. Many farmers feed hogs for weeks and months just on dry ear corn, and keep them confined in lots where they have but little chance for exercise. Too rapid change from one class of food to another is also a frequent cause for acute inflammation of the stomach. This is especially likely to occur early in the fall of the year when commencing to feed green corn or pumpkins. These foods must be gradually introduced into the diet, as otherwise they are likely to cause disastrous effects.

In the medication of animals for the purpose of ridding them of worms or for other causes a severe gastritis may be set up as the result of giving some irritating drug in too strong a solution. This is especially likely to occur where such agents as copperas are used. In some cases acute gastritis has been caused by the feeding of hog-cholera medicines which contained large amounts of these irritating worm remedies.

Acute gastritis is often seen in hot weather in fattening hogs, as a result of overdrinking of cold water, chilling the stomach, and causing an acute attack of inflammation. Overexertion, as by fighting with strange hogs or overheating from any cause, may be followed by an attack of gastritis.

In sucking pigs the disease is quite common, and is the usual start of scours, which carries off large numbers of the little fellows every year. In pigs it may be due to improper quality of the

mother's milk, irregular nursing, or, a little later on, to eating from the troughs food which they are incapable of handling. Foods which the other hogs may be able to eat without producing severe harm will kill these little pigs, as a result of the severe inflammation they cause in the stomach.

Secondary Gastritis.—An acute gastritis is commonly seen as a complication of a number of the other acute diseases of swine. Particularly is this the case in hog-cholera. The stomach of the hog in hog-cholera is often very red and inflamed, and not infrequently one or more small ulcers may be found quite similar in appearance to those found in the bowels.

Acute gastritis may also occur as a secondary disease after inflammations of the mouth and throat, or as a result of diseases of the teeth and gums. An animal with sore teeth and sore gums cannot properly chew the food, and, as a result, it gets into the stomach in hard masses which often scratch and irritate the stomach so as to set up a severe gastritis.

Postmortem Appearance.—If we open up the body of an animal that has died as a result of acute inflammation of the stomach we will find that the inner lining of the stomach is swollen, reddened, and covered with a thick coat of sticky, mucus-like substance. The food present in the organ usually has a decidedly sour, disagreeable odor, and may often appear frothy and filled with gas.

Symptoms.—The first noticeable symptom of gastritis is loss of appetite. There may be an entire loss of desire for food in the severe cases. In the milder cases there is noted a marked decrease in appetite. The animal eats slowly and without the usual greediness which characterizes the appetite of the healthy pig.

In the more severe cases there is sudden loss of all desire for food and often an attack of vomiting. The animal shows a tendency to remain in its nest, or to go off in some quiet corner and lie down. When the animal stands, it arches the back and holds the abdomen tense. The tail droops, and the general appearance of the sick hog is that of unthriftiness. When roused up, or any attempt is made to handle the hog, he shows by grunting that he is in severe pain.

With the onset of the disease the animal becomes quite feverish, and the skin gets hot and dry. Thirst is usually increased, but all

desire for food is lost. Frequently even the drinking of water will be sufficient to cause a severe attack of vomiting. In some of the less severe cases the animal will show evidences of a depraved appetite. He may eat one kind of food and refuse another, or may refuse all ordinary food and show a desire for unusual and indigestible substances. The use of the thermometer usually shows the presence of one or two degrees of fever, and examination of the surface of the body with the hand will determine that the tips of the ears and extremities of the limbs are cold, while the balance of the body appears to be hot.

The bowels are usually constipated at first. Later they begin to show a diarrhea, and the discharges may finally become quite watery and disagreeable in nature.

The urine is decreased in amount and very often is decidedly dark in color.

Diagnosis is made by the history of improper feeding, and the symptoms of loss of appetite, vomiting, pain, fever, thirst, and diarrhea. The principal disease to be considered as a possibility is hog-cholera. This is always to be thought of, and, in cases where cholera is in the neighborhood, it is the part of wisdom to kill one of the sickest animals and open up the body for the purpose of making certain whether cholera really is starting in the herd or not. The fever is usually much higher in a case of cholera than in simple gastritis.

Treatment.—Preventive treatment, of course, consists in proper care as regards diet. Wholesome food in proper amount at regular intervals will make this disease an unknown one in the herd. Where an attack occurs, the first thing to do is to get the irritating substances out of the stomach. This is best done by the use of 15 to 20 gr. of ipecac in warm water, or by the injection under the skin of ¼ to ½ gr. of apomorphin. This should be followed by the giving of calomel and castor oil, using about 3 to 5 gr. of calomel and from 1 to 4 ounces of oil. This will thoroughly clear out the stomach and bowels, relieve vomiting, and is frequently all the medication that is needed.

The animal should be given no food whatever for the first twenty-four hours after treatment is started, and should then be gradually placed on soft mashed food for a few days. To aid com-

plete recovery some tonic condition powder may be given for several days with advantage.

CHRONIC INDIGESTION (CHRONIC GASTRITIS)

Definition.—This is a condition in which there is a chronic inflammation of the lining membrane of the stomach, and the animal becomes unable to digest food in the proper manner. The condition is not as common in hogs as it is in the larger animals, such as the horse and the cow.

Causes.—The causes for chronic indigestion are practically the same as those for acute inflammation of the stomach. The main cause is long-continued irregularity in feeding and long-continued feeding with an improper ration. At first the animal may show a response to this improper treatment by attacks of acute inflammation of the stomach, but later, as the stomach becomes more accustomed to abuse, these acute attacks are less frequent, and the animal passes into a chronic condition of impaired digestion and the stomach gradually becomes less and less able to perform its proper function.

Long-continued feeding on an exclusive corn diet is a very common cause of chronic indigestion. Continued feeding of kitchen and hotel garbage is another common cause. The presence of stomach and bowel worms may frequently produce a chronic gastritis. When, for any reason, the animal becomes weak and debilitated, there is a weakening of the digestive powers and a chronic dyspepsia is the result. Accordingly, we may expect to see this condition in animals that are badly ruptured or that suffer from long-drawn-out diseases, such as chronic hog-cholera. In the latter disease chronic indigestion is always present as a prominent symptom. Animals that are kept housed in overheated quarters, as around a manure pile or straw-stack, and who receive insufficient exercise, usually become sufferers from the chronic form of indigestion during the winter.

Symptoms.—The chronic form of indigestion is usually preceded by one or more attacks of acute gastritis, in which the animal shows the usual symptoms of loss of appetite, vomiting, fever, and diarrhea. After one or more of these severe attacks, if proper change is not made in the manner of feeding, the condition becomes

three or four days. This drug is in the form of a white, tasteless powder, and can be very easily administered with the food.

Change of diet, increasing the range, plenty of fresh, clean water, and the intelligent administration of the above-mentioned remedies will clear up the condition in a few days in most cases. In the more severe cases, and in those that are due to chronic cholera, longer treatment may be necessary. In these cases much benefit may be derived from the use of some form of intestinal antiseptic in combination with the above tonic powder. The best of these intestinal antiseptics are the sulphocarbolates of soda, calcium, or zinc. In most cases the sodium sulphocarbolate is the preferable one, and may be added to this powder in such amount that the animal will receive from 5 to 15 gr. at a dose. Where there is a chronic diarrhea it is better to make use of the zinc sulphocarbolate.

In those cases which are due to chronic cholera, and where the hogs are badly stunted, the outlook is hopeless, and it is a waste of time and money to treat these animals. It is the part of economy to simply knock them in the head. Their stomachs have been so damaged that they will never be able to properly digest food, and they will never be able to show a sufficient return for the grain put into them to give a fair return for its value.

INFLAMMATION OF STOMACH AND INTESTINES (GASTRO-ENTERITIS, INFLAMMATION OF BOWELS)

In nearly all cases where we have inflammation of the stomach there is also an inflammation of the bowels accompanying it. It is almost impossible to say when the disease is in the stomach and when it is in the intestines. The symptoms in each case are about the same, and, as stated, in a great majority of cases both stomach and bowels are involved at the same time. It is for this reason that we will consider the two together, under the head of gastro-enteritis, or inflammation of the stomach and bowels.

Causes.—The causes for inflammation of the stomach and bowels are just about the same as those already mentioned under the head of Acute Gastritis. Improper feeding is the main point. This is especially true of feeding the animals with dirty, decomposed, and rotten foods. The stomach of the hog is able to stand

an enormous amount of abuse, but even the worm will turn at times, and there is a limit to what the stomach and bowels of even a hog can endure. When we place the animals in dirty, filthy, dark, damp quarters, and then feed them with sour, decomposed kitchen swill, fermenting distillers' mash, and other decomposing and unwholesome foods it is not surprising that inflammation of the entire length of the digestive tract develops.

The disease is especially likely to occur in young pigs and shoats. The pigs often become diseased as a result of improper feeding on the part of the mother. Where sows that are suckling pigs are fed on these rotten, filthy foods it is only natural that a certain amount of the poisonous materials are transmitted through the milk to the litter, and result in the development of an inflammation of the stomach and bowels which soon proves fatal in these little fellows. Intestinal worms is another not infrequent cause for gastro-enteritis in young pigs and shoats.

Gastro-enteritis is seen as a complication in almost all cases of cholera. In the acute forms of cholera the gastro-enteritis is often very severe, and may be seen postmorten as a bright-red discoloration of the entire length of the intestine as well as the inner lining of the stomach.

Symptoms.—The most prominent symptoms of a severe inflammation of the stomach and bowels are loss of appetite and severe abdominal pain. The pain in the belly is usually quite severe. The animal stands with the back arched, the abdomen tucked up, the ears drooped, and the curl has disappeared from the tail. The desire for food is usually entirely lost, although the sick animal is usually quite thirsty and will drink considerable amounts of water. The inflammation, if severe in the stomach, frequently causes quite severe vomiting. This vomiting is especially likely to occur after eating, or after nursing in sucking pigs.

Diarrhea is also a prominent symptom in most cases. At the very beginning of the attack the bowels may be constipated for a few hours, but this is followed later on by a profuse and offensive diarrhea. The color of the bowel discharges will vary somewhat with the nature of the cause and the nature of the food which has been eaten. Some cases show a watery, almost colorless, diar-

chronic. There is a loss of appetite and the animal becomes unthrifty. There may be a very capricious appetite. The animal may eat well to-day and refuse food entirely to-morrow. In some cases there will be an appetite for one kind of food and an absolute refusal of other forms of food.

Instead of gaining in weight, as a healthy hog should, the affected animal loses weight. In the case of small pigs this becomes very noticeable, and, unless the condition be early corrected, the animal becomes a chronic runt and is stunted beyond hope of ever becoming a valuable animal. In those cases associated with chronic cholera the loss of weight is very characteristic, and a large, thrifty appearing animal may become so emaciated as to resemble a walking skeleton in a few weeks' time.

The condition of the bowels in this condition is very changeable. There may be a chronic constipation or the animal may have more or less scouring. In many cases there are some days on which the animal is constipated, and this may be followed by several days of diarrhea. Attacks of colic occur quite frequently, in which the animal becomes restless and gives other evidences of abdominal pain.

Course.—The condition may persist for several weeks or even months unless properly treated. The animal loses weight and strength and becomes hopelessly stunted.

Treatment.—As in the acute form of inflammation of the stomach, there is a great amount of work that can be done to prevent this disease, and it is much easier to prevent the condition than it is to treat it after it has once become established.

Properly balanced rations, given in proper amount and at regular intervals, will do a great deal to keep the animals free from any stomach or bowel troubles. Careful watch should be kept for the presence of worms, and, if they are present, proper medication should be given to rid the animals of them.

Clean, properly ventilated quarters is a big factor in preventing this condition as well as many other diseases of the hog. Sleeping quarters should be so arranged as to have plenty of room, and they should be warm and at the same time light and properly ventilated. The animal should also have sufficient feed lot space to properly exercise. The hog, as well as other animals, requires a moderate

amount of exercise in order to keep his digestive apparatus in proper working order.

Chronic gastritis should never be neglected, as not only does it make the animals unprofitable from a feeding standpoint, but it also opens the door for invasion by the hog-cholera germs. An animal suffering from chronic indigestion is an open invitation for hog-cholera, and this disease is always ready to accept an invitation from almost any feed lot. Keep the digestive tract of your animals in good working order, and give them clean, wholesome food, good clean water, and proper quarters in which to sleep, and you have done a great amount of good in preventing cholera in your herd.

In beginning the medicinal treatment of this disease it is well to start in with a good-sized dose of calomel or some other physic. Cut down the amount of food for a few days, and let the animal get up a good appetite. Give a wider range and allow the hog to forage partly for his food. Then, with the food, give a good bitter tonic mixture. The following combination makes a very valuable one:

Powdered gentian	1 ounce
Powdered nux vomica	1 "
Sulphate of iron	1 "
Bicarbonate of soda	6 ounces.
Sulphate of soda	6 "

Mix this thoroughly to form a condition powder, and give a teaspoonful to each animal once or twice daily with the food. This preparation tones up the mucous membrane of the stomach, increases the appetite, improves the quality of the blood, and aids in ridding the animal of intestinal worms if any be present.

Another good mixture for use in this condition is the hog-cholera preventive remedy mentioned in the section on The Treatment of Hog-cholera.

If there be a severe diarrhea which is not checked after the animal has had a physic and this tonic mixture for a couple of days, it is wise to give a few doses of subnitrate of bismuth. This may be given in half to teaspoonful doses, according to the size of the animal, and should be repeated two or three times a day for

three or four days. This drug is in the form of a white, tasteless powder, and can be very easily administered with the food.

Change of diet, increasing the range, plenty of fresh, clean water, and the intelligent administration of the above-mentioned remedies will clear up the condition in a few days in most cases. In the more severe cases, and in those that are due to chronic cholera, longer treatment may be necessary. In these cases much benefit may be derived from the use of some form of intestinal antiseptic in combination with the above tonic powder. The best of these intestinal antiseptics are the sulphocarbolates of soda, calcium, or zinc. In most cases the sodium sulphocarbolate is the preferable one, and may be added to this powder in such amount that the animal will receive from 5 to 15 gr. at a dose. Where there is a chronic diarrhea it is better to make use of the zinc sulphocarbolate.

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rhea; others, a yellow discharge, and in young pigs the bowel movements are frequently green in color. In the cases associated with hog-cholera a black-colored discharge is very frequently seen.

Lack of ability to eat and the exhausting drain from the diarrhea tend to weaken the animal very rapidly, and it is not long until he is unable to stand. From the very start there is loss of all desire to move about, and the animal prefers to remain in his nest or huddled off in some corner of the feed lot. If any attempt is made to handle him, he shows by grunts and squeals that he is suffering intense pain, and especially is this noted if any attempt be made to palpate the abdomen. If the temperature be taken it will usually be found to be high, although in some of the very severe cases there may be no fever, and instead we may find a subnormal temperature.

Weakness becomes more pronounced, the animal refuses to move, and, if forced to his feet, staggers about in an uncertain manner, and immediately lies down again as soon as left to himself. Death may take place in a few hours unless treatment is given to relieve the condition.

Course.—In the acute cases the course is rather short. If the disease be severe in nature, death is likely to be produced in a few days. Especially is this true in the case of small pigs which have sickened as the result of improper milk. In other cases, where the symptoms are more mild, the disease may last for several days and then pass gradually into a chronic form, which may last for several weeks or even months, producing a chronic runt which is worthless from the feeding standpoint.

Treatment.—Here, as in other inflammations of the stomach and bowels, a little prevention is worth tons of cure. Proper attention to diet and the feeding of clean, wholesome food will do an enormous amount of good in preventing the occurrence of this disease. Especially should care be used in the feeding of sows that have a litter of sucking pigs. These little fellows are unusually susceptible to the action of poisonous substances upon their delicate stomach, and bowels. Plenty of room and light, airy quarters should also be provided for the litter, in order that they may have sufficient room to exercise.

Active treatment consists, first of all, in clearing out the irri-

tating agents which may be in the bowel and stomach and which are causing the trouble. This is best done by the use of calomel, given in doses of from 5 to 20 gr., depending upon the size of the hog. Small pigs should receive 1 to 2 gr. This is best given in the evening, and should be followed the next morning by a dose of castor oil, giving from 1 to 6 ounces, depending upon the size of the hog. By this means we will clear out the stomach and bowels and remove the irritating and poisonous materials that are causing the trouble.

At the same time it is an excellent plan to shut off all solid food for a period of forty-eight hours, giving only a small amount of water to which some barley or bran might be added. By making a thin gruel of this bran and water we have a substance which is easily taken, readily digested, and acts as a soothing remedy to the inflamed mucous membrane. Where the pain and diarrhea are very severe, small doses of laudanum may be added to this gruel, giving from ½ to 1 teaspoonful, depending upon the size of the hog. In young shoats and in pigs the use of subnitrate of bismuth is better, giving ½ to 1 teaspoonful every three or four hours for several doses. This forms a protective coating on the lining of the stomach and bowels, relieves the vomiting and diarrhea, and checks the pain. It is a most effective agent, and should be remembered wherever diarrhea is a prominent symptom.

If there is intense fever and marked weakness, small doses of tincture of aconite and tincture of belladonna are very effective. Ipecac added to this mixture in small doses will have a most beneficial effect. The dose of ipecac should be very small, only a fraction of a drop being given at each administration.

After the acute symptoms have subsided the animal must be carefully fed for several days and gradually brought back to a full diet. Efforts must be made to discover the cause for the attack, and such changes made in the method of feeding as will prevent a recurrence of the condition. Give the animals a better range, feed rather lightly for a few days, and allow them to get plenty of exercise. Avoid those foods which are decomposed, rotten, or souring, and give good, clean, wholesome food in proper quantity and at regular intervals.

In those cases where the diarrhea proves persistent and weakening the use of an intestinal antiseptic is indicated. The best of these is the sulphocarbolates, using the sodium, calcium, or zinc salt, or a combination of the three. These sulphocarbolates liberate carbolic acid in the stomach and bowels and destroy the germs which are proving the cause of the inflammation.

In cases that show a tendency to develop into a chronic indigestion the use of the bitter tonic condition powder already mentioned is indicated.

DIARRHEA IN YOUNG PIGS (SCOURS)

Scours is a very common disease in young pigs, and carries off a large number of the little fellows in the hog-producing belt every spring. There is no single disease, with the exception of cholera, that causes such severe losses to the swine-producing industry as does scours.

Causes.—The disease is practically always due to faulty food. If the mother be in a feverish or unhealthy condition in the first few days after birth her milk becomes unsuitable for food for the pigs, and they develop a severe diarrhea as a result. Improper feeding of the mother is also a common cause for scouring among the pigs. Feeding of decomposing, rotten, or frozen food to the mother will result in poisonous materials being carried through the milk of the mother to the stomach of the sucking pig, with disastrous outcome.

Where the pigs are kept in close, damp quarters, scours is especially liable to develop. The little pig needs light, airy quarters, with plenty of sunshine and room for exercise. On many farms the farrowing sow is placed in an overheated, damp, dark shed, and it is no wonder the pigs in such litters begin to die when a few days old.

Scours are especially liable to develop if the weather be damp and chilly. Cold, rainy spring weather is especially favorable to the development of this disease in a litter of new-born pigs. The little fellows get out in the damp grass and get chilled through, with the result that their strength is very much lowered, and they easily fall victims to any poisonous substances that may be taken in with the milk.

The pig, in order to be healthy, must have the milk of its own mother. In cases where the sow dies or refuses to suckle the pigs, and an effort is made to bring them up by hand on cows' milk, scours very often starts up in a few days. The milk of the cow is all right for calves, but it does not seem to be suitable for little pigs, and they soon die when forced to live upon this artificial diet. The same seems to be true, to a certain extent, in the case of the milk from other sows. Pigs often develop scours when forced to suckle another sow. Especially is this the case if the new mother has a litter of pigs a week or two older than the new addition to her family. The milk changes a few days after farrowing and becomes stronger each week. For this reason the milk of a sow that has farrowed two or three weeks previously is not suitable for new-born pigs, and they will not do well on it.

The age at which this disease may appear varies from the first day after birth up to several weeks after farrowing. In some cases the disease may set in so soon after birth that it almost seems as if the pig was born with scours. In those cases that come on several days or even weeks after birth the condition is usually due to a gastro-enteritis and chronic indigestion. In these cases the onset of the diarrhea is usually preceded by several days of constipation.

In some seasons this disease is especially common, and seems to exist almost as a contagious or infectious diarrhea, such as is seen in foals and calves.

Symptoms.—The most prominent symptom is the diarrhea or scouring. In the very young pigs this may be noticed almost on the first day after they are born. The bowel movements are almost watery in character, usually of a grayish or grayish-yellow color, and have a very foul, disagreeable odor. The longer the disease keeps up, the more liquid the discharges become and the more foul the odor. They also become quite irritating and stain the tail and hind parts of the animal.

At the beginning of the attack the appetite is often quite good, and it may remain so for a day or two after the discharge starts. The sick pig soon loses all desire for food, and rapidly loses flesh and strength. The animal becomes very weak, stunted in appearance, and stands around with the head down, tail drooping, and

the abdomen drawn up. The hair becomes rough and unhealthy in appearance and the little sufferer may give frequent evidence of pain by squealing and grunting.

This condition of affairs gradually becomes worse, and unless something is done to give relief the animal will die in the course of a few days. The outcome is especially bad where the disease starts in the first few days of life. The younger the animal, the less chance there is for recovery.

Treatment.—As in many of the diseases which have already been described, the prevention of scours is of more importance than its medical treatment after it has fully developed. The pregnant sow should be kept in clean, hygienic quarters, and given nothing but clean, wholesome food. No sour swill, distillers' mash, or moldy grain should be allowed. The quarters in which she is placed for farrowing should be clean, dry, roomy, and so arranged as to allow of the entrance of sunshine. There is no other single agent that is as beneficial for young pigs as plenty of sunshine.

If the mother appears feverish after farrowing it is well to give her a light physic of castor oil and feed very carefully for the next twenty-four hours.

In the active treatment of the pigs it is best to give them a small dose of calomel to start with, say 1 to 2 gr., and follow this with ½ ounce of castor oil. This, with proper attention to the diet of the mother, will often be all that is necessary. In some of the more severe cases it will be indicated to give something to check the diarrheal discharge. In these cases ½-dram doses of subnitrate of bismuth and sodium sulphocarbolate may be given, or small doses of laudanum. The laudanum may be given by dropping 2 or 3 drops on the tongue of the sick pigs, or ½-teaspoonful doses of paregoric may be given. The administration of opium as a means of treating diarrhea in man or animal is bad practice, and often finally results in the loss of an animal that might otherwise have been saved. It is far better to give something that will clean out the bowel, sweep out the irritating substances therein contained, and then follow this with some intestinal astringent and antiseptic, such as bismuth and the sulphocarbolates. The use of opium should only be resorted to in those cases where it becomes

absolutely necessary to use some agent which will check the severe discharge.

After the diarrhea has been checked, the animal will often be improved by giving small doses of some tonic medicine, such as tincture of nux vomica, in 1-drop doses, for several days.

DYSENTERY (DIARRHEA)

Diarrhea has already been mentioned as a symptom of a number of diseases. It may be said hardly to exist as a separate disease. More often it is merely a symptom of an inflammation of the stomach and bowels. However, we do have some cases in which there are frequent evacuations of the bowels, and yet in which there are hardly present those conditions which would entitle the condition to be classed as a gastro-enteritis.

Causes.—The causes for this condition, as well as for most of the disturbances of the stomach and bowels, are improper feeding, and especially the feeding of improper articles of diet. Sudden changes in the food, feeding of green corn or rye, irritating, decomposed or molded foods, kitchen garbage, and lack of variety in the food are the conditions which bring on dysentery in the hog. Overcrowding with food, resulting in eating more than the stomach and intestines can handle, is another common cause for dysentery. Irritation from intestinal worms frequently causes a chronic diarrhea.

Symptoms.—The symptoms are simply a chronic looseness of the bowels. The animal passes large numbers of stools each day, or may have alternate days of constipation and diarrhea. There is an absence of the severe symptoms which make up the picture in acute gastro-enteritis. Fever is usually absent and there is no vomiting and no complete loss of appetite. Abdominal pain is very slight or entirely absent.

The sick animal may have a fairly good appetite at times, and, again, may show almost a complete absence of desire for food. The food taken does but little good, and the hog does not gain in weight. On the other hand, he may show an actual gradual loss of weight.

Treatment.—Prevention consists in careful regulation of the diet of the animal. Give only clean, wholesome foods, and give

these in proper quantities and at regular intervals. If the diarrhea be simply the symptom of some other condition, as irritation of the bowels from some poison or the presence of worms, the underlying condition should be first treated and the dysentery will quickly clear up of itself.

In the active treatment of the diarrhea the first indication here, as in other disturbances of the stomach and bowels, is to remove irritating material from the bowels. This is best done by giving a free dose of calomel, followed by castor oil. In large animals calomel may be given in doses of 5 to 20 gr.; oil, in doses of 3 to 4 ounces.

After the bowels have been thoroughly cleaned out with the calomel and oil, begin the administration of intestinal antiseptics and astringents. Bismuth, salol, sulphocarbolates, and bicarbonates of soda are the most efficient remedies. A valuable combination is the following:

Bismuth subnitrate	1 ounce.
Sodium sulphocarbolate	1 "
Sodium bicarbonate	2 ounces.

Mix and form a powder.

Give from ½ to 1 teaspoonful of this powder, according to size of animal, three or four times a day. In a few cases it may be necessary to resort to the use of laudanum, but it is always a good plan to try other methods of treatment first and keep away from the opium if possible.

SPASM OF DIAPHRAGM (THUMPS)

Thumps, while really a disorder of the nervous system, is so commonly associated with irritation of the stomach and bowels that I consider it better to discuss this condition under the head of diseases of the digestive tract.

Thumps is a condition very commonly seen in young pigs, and consists in a spasmodic or jerking contraction of the diaphragm. The diaphragm is the fan-shaped muscle which separates the organs of the abdominal cavity from those of the chest. The diaphragm is sometimes known as the midriff. In cattle it is known to the butchers as the skirt. This muscle is supplied by a very important

nerve, known as the vagus or pneumogastric. Any irritation of this nerve will produce the irregular spasm-like contractions of the diaphragm which are known as thumps. In man these same spasmodic jerkings of the diaphragm are known as hiccup.

Causes.—Thumps was for a long time believed to be due to palpitation of the heart. In fact, there are many men to-day who will call the condition palpitation of the heart. This is a mistake, as can be very easily determined. If the hand is placed over the heart, and the heart-beats counted at the same time that the contractions of the diaphragm are noted, it will be seen that there is no relation between the two.

The direct cause of thumps is any irritation of the nerve which supplies the motive power to the diaphragm. This irritation may be caused in a number of ways. Among the most common causes are diseases of the digestive apparatus. Inflammation of the stomach and bowels are often complicated by the development of thumps. This is a sign of a very severe inflammation, and frequently means death for the sick animal. Thumps are especially common in young pigs. Lack of exercise and overloading of the stomach are other very frequent causes of the disease in young pigs. Absorption of chemical poisons, as from the drinking of carbolic acid or bichlorid solution, is a not infrequent cause for thumps. Diseases of the chest and heart or inflammation of the spinal cord may result in thumps. In hog-cholera thumping often develops as a complication late in the course of the disease.

Symptoms.—The most prominent symptom of thumping is the jerking movement of the body. At each contraction of the diaphragm there is a bulging out of the flanks and a drawing in of the ribs. Sometimes at each thump there is a peculiar sound made resembling somewhat the noise produced by hiccup in man. The symptoms are usually worse when the stomach is full. These thumping movements may be forcible enough to sway the body back and forth. In some cases the thumping occurs at the same time as the heart-beat, but in the majority of cases it is irregular in time and bears no relation to the heart-beats.

Course.—The course of this condition is variable. It may last a few days or for several weeks. In long-drawn-out cases the animal loses flesh and becomes run down and stunted.

Treatment.—The prevention of this disease in young pigs consists largely in giving them plenty of room in which to exercise and light, airy quarters, with plenty of sunshine.

Active treatment is directed, first of all, to getting the animals into a range where they will have plenty of room to exercise and plenty of sunlight to stimulate and enliven them. Castor oil or calomel may be given to clean out the stomach and bowels in those cases where there seems to be irritation of the digestive tract. For controlling the spasms of the muscle the most effective agent is tincture of opium, which may be given in doses of 3 to 15 drops, according to size of the animal. The diet should be very light for a few days, and the animal encouraged to forage about and get exercise on a rather hungry stomach.

WHEAT AND BARLEY BEARD INFLAMMATIONS

When hogs are turned into a wheat or barley stubble, or allowed to burrow around a wheat or barley straw-stack, they often develop inflammation of the mouth and bowels and die. The cause of the trouble is the penetration of the sharp beards of the wheat and barley into the lining membranes of the mouth, gullet, stomach, and intestine. This sets up a severe form of inflammation and in many cases produces death.

The symptoms of the condition will differ in each individual case. In some instances most of the trouble appears to be in the mouth, and in these cases the beards will be found sticking in the lining membrane of the mouth and tongue or may be rolled up in a ball beneath the tongue. They also often involve the upper air-passages, and in these cases there is considerable difficulty in breathing. In other cases the disturbance is more marked in the bowels, and there may be diarrhea, loss of appetite, and abdominal pain.

Treatment.—In those cases where the trouble is located in the mouth the beards should be removed in so far as possible, and the treatment advised for stomatitis given. Take the animals off of the wheat stubble and feed only with soft, easily digested food. In those cases that involve the intestines or the upper air-passages but little can be done. Where inflammation starts around the upper part of the wind-pipe there is apt to be such swelling as will cause

the animal to die from suffocation. In the intestinal cases, placing the animals in a different feed lot, feeding with soft food, and giving a dose of oil may produce good results in a number of cases.

CONSTIPATION

This is a condition in which there is a failure of the bowels to empty themselves, and the feces are retained, to become hard and dry. It is a condition which is rather uncommon in the hog, being more frequent in horses and cattle.

Causes.—The principal cause for constipation is improper feeding, combined with lack of exercise. Overfeeding or feeding with an exclusively dry diet is a very common cause for the condition, and this is especially true where the animal is in close, poorly ventilated quarters and does not get sufficient exercise.

In animals that are affected with intestinal worms the development of constipation is not unusual. In chronic indigestion constipation is a common symptom. Just before the development of the diarrhea in acute inflammations of the stomach and bowels constipation is the rule.

In hog-cholera the condition early in the disease is that of constipation. This may be followed a few hours or days later by diarrhea of the characteristic black, fetid character. In some cases of cholera the condition remains one of constipation throughout the course of the disease.

Fattening animals which are kept in close quarters and overcrowded with feed for the purpose of rapid development of fat often become severely constipated. This is especially likely to occur if they are fed largely on dry food and given an insufficient amount of water. In the winter months constipation is very common, as the animals are likely to remain huddled together much of the time, taking but little exercise, and they are also likely to drink but little water. Especially is this true if the water which is provided for them be ice cold, as is often the case.

Symptoms.—The most prominent symptom is frequent straining attempts to defecate, with the passage of little or no droppings. The feces that are passed are usually very dry and hard, and are often covered with a slimy mucus. As the condition is usually accompanied by more or less indigestion, the appetite becomes

poor, and the animal may show frequent evidences of colicky pain in the abdomen. In the straining efforts to defecate the animal may simply turn the lower end of the rectum inside out, the condition being known as eversion of the rectum. This is especially likely to occur in those cases that are brought on through eating large amounts of dry food. In the more severe cases the animal becomes dull, stupid, and shows a tendency to remain off by himself. He seeks some shaded corner, and there lies down and remains quiet. If the animal be caught and examined, the hard dry masses in the intestine can often be felt even through the belly wall, and there may be considerable abdominal tenderness.

Treatment.—In the prevention of constipation the main point is to avoid the use of an excessive amount of dry food. There should be sufficient variation offered that the animal may not be required to use simply a dry diet. Some sloppy food should be included in the daily diet, and the animal should have sufficient room to get a reasonable amount of exercise daily. Water should always be provided in abundance, and in cold weather it should be heated to the point where it can be drank with comfort.

The active treatment of constipation consists in so modifying the diet as to restore the normal function of the bowel. All dry food should be withheld and sloppy food given instead. A mild laxative of some nature is indicated, such as castor oil or linseed oil. Plenty of water should be provided, and this water must be of a temperature which will allow of its being taken without chilling the body of the animal. If the hogs are in too close quarters, allow them a little more room.

If the case be a very severe one, with complete stoppage of bowel movements, it will be necessary to use a rectal injection of soap and water in order to get the bowels to moving well. In these severe cases it is well to treat the condition of the bowels and stomach for a few weeks. For this purpose one of the tonic mixtures already mentioned should be administered.

POISONING

Poisoning by various forms of chemical agents has already been referred to under the head of Diseases of the Stomach and Bowels. Owing to the utter carelessness which exists in the feeding

of hogs, it is not to be wondered at that we meet with numerous cases of poisoning as the result of chemical irritants carried in with the food.

Poisoning from Carbolic Acid.—At the present time there are a large number of stock raisers who use various forms of carbolic acid preparations for dipping of animals and as antiseptic solutions in washing off the skin of the animal before injection of serum, castration, and other similar surgical operations. Not infrequently these solutions are thrown on the ground in the feed lot when the operation is over, and the hogs naturally wallow in, and drink from, the artificial mud-puddle thus created.

If these solutions are strong and a sufficient amount is taken there may be produced symptoms of carbolic acid poisoning. The principal symptoms are those of gastro-intestinal irritation, with a very marked degree of depression. In most cases there is not enough of the drug taken to produce very severe symptoms, the most common being those of a severe diarrhea and considerable muscular weakness. The urine may be dark in color and have a peculiar odor.

Treatment in the acute cases consists in emptying the stomach as soon as possible with an emetic, such as apomorphin or ipecac. This should be followed by the administration of very large doses of magnesium sulphate or Epsom salt. The dose of the salt should be large, from ½ to 1 pound being given to large animals.

Poisoning from Bichlorid of Mercury.—This drug is also in common use among stockmen and veterinarians as an antiseptic and germicide. In the same manner as in the case of the carbolic acid solutions this agent may be scattered about on the ground, where it will produce poisoning if taken into the stomach of the animals in the feed lot.

Symptoms of bichlorid of mercury poisoning are most pronounced in the stomach and bowels. The animal is usually nauseated, vomits, has a severe diarrhea, and shows considerable muscular weakness and abdominal pain.

Treatment consists in the use again of a prompt emetic, such as apomorphin or ipecac. When the stomach has been emptied, some soothing agent should be given—white of egg being the best agent to check the action of the drug on the stomach. The agents of choice

for use after emptying of the stomach are milk, Epsom salt, and lime-water. To prevent after-effects of the drug, potassium iodid, in 10- to 15-gr. doses, may be used.

Poisoning by bichlorid of mercury, if severe, is a very dangerous form of poisoning, and is likely to prove fatal.

Poisoning from Meat Brine.—This is a very common form of poisoning in hogs. The hog seems to be peculiarly susceptible to the action of salt as an irritant of the stomach and bowels. Under ordinary conditions, if common salt be placed in front of hogs, even in large quantities, they will eat but very little of it. However, when combined with the extractives from meat or fish, as in the case of meat or fish brine, they will drink large quantities of the strong salt solution with very disastrous effects.

On the farms salt brine is very commonly used as a means for preserving meat for the summer use. When the meat has been several weeks in the cure or pickle, as it is called, it is taken out and further preserved by means of smoke. In many cases the brine which remains in the barrel is taken out and poured in the hog troughs and the hogs allowed free access to it. There is something about the smell of the meat in the brine which attracts them, and it is not long until they will have drunk enough of the salt solution to produce very bad effects. In many cases, where hogs are fed upon the swill collected from city restaurants, hotels, groceries, etc., the brine from empty fish kegs is dumped into the swill. This brine is very strong in salt, and a small amount of it will be sufficient to produce symptoms of poisoning in the hogs.

It takes but a few minutes after drinking the brine for symptoms to develop. The animal will first be noted to be restless. He runs about the feed lot in an uncertain sort of manner and squeals. He will lie down for a moment, and then jumps up again and runs along the fence, squealing and stamping the feet. Finally, the irritation becomes more marked. The animal begins to froth at the mouth, and is seized by a convulsion, in the course of which the muscles become rigid and the hog throws himself around in a violent manner. The pain is now severe, and the sick animal gives evidence of it by frequent squeals and grunts. Convulsions follow each other in rapid succession, each seizure being more severe than the one before.

Vomiting is always a prominent symptom. Pain becomes more severe as the case proceeds, and finally the animal begins to pass into a sort of stupor. The hind parts become paralyzed and the animal dies in convulsions. In some of the less severe cases the animal may live for several days. In these cases the most pronounced symptom is a watery diarrhea.

Treatment.—An emetic should be given just as early as possible in these cases to get the irritating substances out of the stomach. The animal can be saved if the condition is recognized early enough, and an emetic given before the poison has begun to get in its severe work. Among the drugs which may be used for their emetic action are apomorphin, zinc sulphate, and ipecac. Apomorphin should be given with the hypodermic needle in doses of $\frac{1}{4}$ to $\frac{1}{2}$ gr.

Plenty of water should be given to dilute the irritant which has passed into the intestine. At the same time a dose of linseed oil may be given for its soothing effect, and also as a means for sweeping out the intestinal canal. In the more severe cases, where the animal acts stupid and shows signs of the depressant action of the poison, stimulants, such as strychnin, should be given. Where the pain becomes severe and the restlessness is marked, tincture of opium may be given in large doses to quiet the animal. Teaspoonful doses of the opium preparation may be given every three or four hours for several doses for this purpose.

Poisoning from Washing Powders.—In the past ten years a large number of washing powders have been placed on the market, to be used in various cleansing operations about the kitchen. These powders contain numerous irritating chemical substances, and, where kitchen slop is used as a part of the food for hogs, these irritating poisons find their way to the stomach and bowels of the animals and produce very severe effects in many instances.

The symptoms produced by this form of poisoning are referred principally to the stomach and bowels. There is loss of appetite, vomiting, and diarrhea. The patient becomes dull and stupid in appearance and loses flesh if the condition lasts several days. There is considerable tenderness of the abdominal walls on examination with the hands, and the animal gives evidence of pain by frequent short grunts and squealing. Late in the condition the animal shows considerable nervousness and muscular weakness.

This muscular weakness may become so pronounced in the hind extremities as to cause lameness and even inability to walk. The temperature may be raised one or two degrees.

Taken all together, the picture in this disease is not greatly different from that seen in hog-cholera, and in many instances the disease has been mistaken for cholera. In most cases it paves an entrance for cholera. The irritation of the stomach and bowels, together with the weakness resulting from loss of appetite and faulty digestion, drag the animal down to the point where it is very easy for the cholera germs to gain a foothold.

Treatment.—The poisonous agent in most of these washing powders is some strong alkali, such as carbonate of soda. These caustic alkalis are best counteracted by the administration of some weak acid substance. Vinegar is one of the best of these and is always at hand. Following this the bowels should be cleared out by the administration of oil, and this may be all that is necessary in most instances. In the more severe cases, with marked pain and inflammation of the bowels, tincture of opium and bismuth subnitrate are the best agents to use. The opium may be given in doses of ½ to 1 teaspoonful; the bismuth powder, in about the same dose.

Ergot-poisoning, or ergot-gangrene, is seen not infrequently in hogs as well as in other domestic animals. It is perhaps more common in cattle, but may occur in hogs as well. The manner in which the hog becomes poisoned by this drug is usually through eating rye or other straw that contains the ergot. Ergot is a form of fungous growth that resembles rust very much and grows particularly on rye. This fungus is collected in many countries and manufactured into a most valuable drug, which is known under the name of ergot.

Hogs may become poisoned by eating the screenings and chaff around a threshing machine or elevator, or by eating the ergot-infected straw in a rye stubble pasture.

Among the first symptoms of ergot-poisoning is lameness. The animal develops a stiff, unsteady gait, not greatly unlike that seen in rheumatism. On examination, the joints and the feet are found to be tender and painful to the touch. If the animal be watched carefully it will soon be found that gangrene is com-

mencing in different parts of the body. The tips of the ears, the end of the tail, and even the lower portion of the legs begin to show small red spots, which later turn black and die. The signs of gangrene are loss of heat, loss of sensation, and development of a black discoloration. Large parts of the ear and the end of the tail finally slough and drop off. Large areas in other parts of the body also slough out and leave deep cavities.

With further progress of the disease the mouth and gums become sore, the eyes are often inflamed, and the animal shows a loss of appetite and decrease in weight. Unless the condition is recognized the animal may continue to lose vitality and strength and finally die.

Treatment.—The development of the above symptoms in a number of animals in a herd, and especially the gangrene, should lead to a suspicion of ergot-poisoning, and a careful examination of the food supply should be made to determine whether or not fungus-infected straw has been fed. If so, it should at once be removed from the diet. The animals should be kept for several days in warm quarters, as the weakened tissues are very easily frozen, and if the animal be exposed to the cold the entire ear and tail may be so frozen as to afterward slough off.

To overcome the effects of the poison already in the system, and also to aid in its elimination from the body, iodid of potassium is the most effective agent. This may be given in doses of 10 to 15 gr., in the slop, twice a day.

Cotton-seed Poisoning.—In the feeding of hogs with cotton-seed meal and other cotton-seed products some widely differing results are seen. It appears in some cases that the cotton-seed can be fed without producing any harm. In other instances it produces quite severe symptoms of poisoning and even death. Many investigations have been made by the United States Bureau of Animal Industry in this connection, and it has been found that the toxic action of the cotton-seed is probably due to a poisonous acid substance which has been named pyrophosphoric acid.

This poisoning is liable to occur whether the cotton-seed be fed ground, boiled, or in the form of droppings from cattle. The danger is much less in those cases where the meal is eaten in the form of cattle droppings, but even in these cases poisoning may at

times develop, especially if the hogs be allowed to follow the cattle for any length of time.

Symptoms of this form of poisoning are slow to develop, and may not be seen for several weeks after the animals begin to eat the cotton-seed or cotton-seed products. The symptoms develop gradually, and consist principally of loss of appetite, dulness, staggering gait, and marked muscular weakness. The breathing becomes difficult and often spasmodic in nature. As the symptoms become more pronounced spasmodic contractions of the diaphragm occur and we have the condition known as "thumps."

In more severe cases there are no noticeable symptoms whatever. The animal which was well in the evening is found dead in the nests in the morning. This is the form which is especially likely to occur where the animals are fed on the raw cotton-seed meal and given large amounts of it. In animals that follow cattle that are feeding upon cotton-seed meal the disease develops more slowly, and shows more of the symptoms mentioned in the preceding paragraph.

Where the disease is somewhat long-drawn-out in nature, the animal develops a number of symptoms due to irritation of the nervous system. Most prominent among these symptoms are loss of sight, restlessness, running around in a circle and butting into objects, such as the fence, trees, and other obstructions which may be seen in the feed lot. The symptoms in these cases are somewhat similar to those produced by gid worms in sheep. The animal finally dies from exhaustion.

Treatment.—In these cases treatment is largely preventive. Cotton-seed meal must be fed with caution, and its extensive use should not be continued for more than two weeks at a time. In the case of animals that are following cattle fed on cotton-seed careful watch must be kept for any signs of ill effects.

Active treatment consists in giving a full dose of castor oil as soon as symptoms are noted. This may be followed by the administration of tonics, such as powdered nux vomixa, iron, and powdered gentian. Change the diet and exclude all cotton-seed or cotton-seed meal products.

mencing in different parts of the body. The tips of the ears, the end of the tail, and even the lower portion of the legs begin to show small red spots, which later turn black and die. The signs of gangrene are loss of heat, loss of sensation, and development of a black discoloration. Large parts of the ear and the end of the tail finally slough and drop off. Large areas in other parts of the body also slough out and leave deep cavities.

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the postmortem examination floors in the large packing houses gives evidence that this disease is of much more frequent occurrence than commonly believed.

The most important single symptom of peritonitis is severe abdominal pain. Pain and tenderness of the muscles of the abdomen are very pronounced. The animal moves about very slowly and carefully, taking very short, carefully measured steps. The head is usually held low and the curl drops out of the tail. The animal will walk in a very straight course, and avoids as much as possible any bending of the body. Later in the disease, when the pain becomes more severe, the animal will lie down, and it is almost impossible to get it to rise.

There is loss of appetite and vomiting is often a marked characteristic. This vomiting is often very severe, and consists not only of the contents of the stomach, but may also contain intestinal contents as well. At the onset of the disease diarrhea is seen, but later on constipation develops and becomes most obstinate in character. Urine is passed at frequent intervals and often in large amounts.

The respirations become rapid and are entirely thoracic in character. There is no movement of the abdominal muscles on inspiration, as in the normal animal. Late in the disease thumps may develop. The temperature is high and irregular. In very severe cases it may become subnormal. The pulse becomes exceedingly rapid and wiry in character. Late in the disease the pulse becomes exceedingly thready and often imperceptible.

In some cases the disease becomes chronic and the symptoms then are largely those of intestinal indigestion. The animal becomes unthrifty and does poorly. In most cases, after a prolonged illness, death takes place. Many cases, however, make a complete recovery, as is evidenced by the finding of healed lesions of the disease on postmortem meat inspection examinations.

Treatment.—The preventive treatment consists in giving proper attention to the treatment of wounds and injuries of the abdominal wall as well as to diseases of the stomach and intestine. Where such operations as spaying, castration, or cesarean section are about to be done, extreme care should be taken to see that everything is perfectly clean. The flank should be carefully

scrubbed with a disinfectant solution, and all instruments intended for use should be sterilized by boiling.

In the active medicinal treatment, if the case be seen early, it is advisable to administer a good dose of calomel, giving about 10 or 15 gr. This should be followed by the administration of about 4 ounces of castor oil. As a further aid in cleaning out the bowel rectal injections of hot soap-suds may be used.

For the pain, large doses of tincture of opium is the indicated remedy. This may be given in teaspoonful doses, repeated every two or three hours as needed. The animal should be allowed only a liquid and light slop diet and should be kept in warm, comfortable quarters.

INFLAMMATION OF BILE-DUCTS (JAUNDICE)

Jaundice, or yellows, as it is sometimes called, cannot be regarded as a separate disease, but occurs rather as a symptom of other diseases. In most cases the condition is one of inflammation of the liver or of the bile-ducts which carry the bile from the liver to the bowel.

Causes.—In the hog as well as in man jaundice may frequently occur as the result of stones in the gall-bladder. Gall-stones are by no means rare in the hog, and I have seen large numbers of them on postmortem in meat-inspection work. One very interesting specimen is to be seen in the museum of the Terre Haute Veterinary College, in which a concretion is formed which fills the entire gall-bladder. The cause for formation of these stones in the bile-passages is unknown, but it is believed to be largely due to over feeding, lack of exercise, lack of fluid in the diet, and the migration of bacteria up into the bile-passages from the intestines.

Jaundice may also occur as a result of infestation of the liver and bile-ducts by liver-flukes. These parasites, by their size and number, block up the bile-passages and cause a stasis of the bile in the liver. As a result, it is absorbed into the blood-stream and carried all over the body. Liver-flukes are not so common, however, in this country as they are in Europe.

Inflammation of the small bowel often causes jaundice by closing the opening of the large bile-duct into the intestine and shutting

off the flow of bile from the liver. In this manner the fluid is dammed back into the liver and absorbed into the blood.

True inflammation of the liver occurs in a limited number of cases, and may be due to the passage of germs up through the bile-ducts. In these cases there is marked swelling and tenderness in the region of the liver.

The liver is often involved in the course of the acute infectious diseases. In hog-cholera, for instance, the liver is enlarged, swollen, and congested, and in the subacute and chronic cases of cholera there may be some jaundice.

As a general rule, however, jaundice may be set down as being a symptom of inflammation of the intestines, irritation of the bile-passages, or gall-stones. These causes will cover the majority of cases.

Symptoms.—The most characteristic symptom of this disease is the deep yellow discoloration of the visible mucous membranes and of the unpigmented portions of the skin. The lining membrane of the mouth, the whites of the eyes, and the skin in the region of the flanks are all colored a deep golden yellow. In animals that are slaughtered for food purposes the yellow discoloration is very easily seen. It is found to not only involve the skin, but also the fat and the deep tissues as well. In a well-marked case of jaundice this yellow color has somewhat of a greenish tinge, and this becomes more marked on allowing the carcass to chill out.

In most cases of jaundice there are well-marked symptoms of disease of the stomach and bowels. This may be due to the fact that the jaundice is a result of some interference with the function of these organs, or it may be due to the lack of bile in the intestine. Bile is very essential for the proper digestion of the food, and without a plentiful supply of bile the intestines will not work properly.

Early in the attack there is usually a few days of constipation, and this is followed by a diarrhea with clay-colored or even white stools. Appetite is very much decreased or even entirely lost, and the animal has an unthrifty appearance. The coloring-matter of the bile is soon noticeable in the urine, and the urine becomes scanty, high colored, and of a greenish-yellow color, resembling very much in appearance machine oil.

The animal becomes very dull and stupid in appearance, and

shows a tendency to remain undisturbed in his nest. There is little disposition to get around, to eat, or to make any efforts of any kind. If untreated the condition becomes gradually worse and death may occur in a few days.

Treatment.—The proper treatment of this disease consists in attention to the underlying cause. This will usually be found to be some form of intestinal disease, either an inflammation of the stomach and bowels or the presence of intestinal worms. This condition must be corrected, and then, as a rule, the jaundice will disappear of its own accord.

For the purpose of clearing up the congestion and inflammation of the bile vessels, as well as clearing out the irritants which may be present in the bowel, there are no agents more efficient than calomel and castor oil: 10 to 15 gr. of calomel, followed by a full dose of oil, will sweep out irritating substances in the bowel and reduce the inflammation of the bile vessels. These agents will also restore the flow of bile into the intestines and re-establish digestion and appetite.

Another agent which I have found most efficient in the treatment of jaundice, not only in the hog but in other animals as well, is chionanthus. This is a vegetable drug, and has a most favorable influence upon inflammation of the bile-passages and also upon inflammation of the small intestine. The best available preparation of this remedy is the Specific Medicine Chionanthus, put up by Lloyd Bros., of Cincinnati, Ohio. Given in doses of 15 to 30 drops every three hours for several doses it restores normal conditions in a manner equalled by no other remedy. It may well be called the "vegetable calomel," and has a decided advantage over the latter drug in that it is not in the least irritating. An excellent remedy to follow the use of chionanthus or calomel in these cases is magnesium sulphate. This should be given in doses of about ½ to 1 ounce, and repeated daily for several days.

The diet in these cases should be light and of a sloppy nature for a few days. All coarse, dry food should be withheld and soft bran mashes and like foods given. Plenty of water should be provided and the animal kept in warm, comfortable quarters which are well lighted and well ventilated. With proper treatment the majority of the cases will recover.

ICTERUS NEONATORUM (JAUNDICE OF NEWBORN)

In some cases young pigs seem to be born with a jaundice or yellow discoloration of the tissues. This condition is known as the icterus of the newborn or icterus neonatorum. The cause for this condition is unknown. Many authorities have advanced the explanation that it is due to infection received during or shortly after birth.

In most cases the disease is associated with severe disturbance of digestion, and the pigs die in the course of a few days from exhaustion and weakness. Castor oil may be given, but usually treatment is of no value.

DISEASES OF THE SPLEEN

These are rather uncommon in the hog as separate and distinct diseases. Most certainly they are never capable of diagnosis as such. In practically all the acute infectious diseases, and especially in hog-cholera, there is involvement of the spleen. The organ becomes enlarged, swollen, and congested, and there must be considerable interference with the function of the organ. The symptoms are never such, however, as to lead to diagnosis of any disease of the spleen.

In postmortem work in the packing houses I have seen some very interesting postmortem changes in the spleen, but, judging from the condition of the animal, they had produced but very little if any disturbance in the health of the animal.

Rupture of the spleen occurs sometimes as a result of severe injury to the abdominal walls, such as being run over by a wagon, and may produce quite severe symptoms. Diagnosis of the condition, however, is made, as a rule, only on postmortem examination.

DISEASES OF THE PANCREAS

Disease of this organ is of little or no importance in the hog. In animals that appear to be perfectly normal a considerable amount of fatty necrosis of the pancreas may be seen. There are no characteristic symptoms produced in the hog by diseases of this organ, and it is not worthy of further discussion.

DISEASES OF RESPIRATORY TRACT

ACUTE CATARRH (COLD IN HEAD, ACUTE CORYZA)

Definition.—Acute catarrh, or cold in the head, is a condition due to inflammation of the lining membrane of the nose and the accessory cavities connected with the nose.

Causes.—Cold in the head is seen most frequently in the winter and spring seasons. It is most commonly due to exposure to wet and cold. This is especially likely to cause cold in the head if the animal be overheated at the time. For instance, in animals that are allowed to burrow under straw-stacks or manure piles, or are kept in sheds which are covered over with a straw-stack or manure pile, catarrh of the head is very common. The hogs, when allowed to sleep in such quarters as these, come out in the morning with bodies overheated, and as soon as the chill winter air strikes them they begin to shiver and shake. In a few hours an acute catarrh of the head has developed. Another cause for cold in the head is the inhalation of irritating vapors. This very commonly occurs when animals are allowed to sleep under a manure pile. The ammoniacal odor that is formed by the rotting manure is very irritating to the nose and will set up a severe inflammation. Foreign bodies in the nose are another frequent cause of catarrh. Animals that are kept in overcrowded and poorly ventilated sheds are also commonly subject to attacks of catarrh during the winter season. The overheating, together with the exposure to draft, is bound to develop a severe cold.

Symptoms.—The first symptom of the onset of a cold in the head is repeated sneezing. Following this the animal will be noted to be a little dull and somewhat inactive. At this time there will be found a slight rise in the temperature, which in severe cases may amount to two or three degrees. The eyes are red and inflamed, and at this time the lining membrane of the nose is also red and swollen.

Within a few hours after the onset of the acute symptoms the disease takes on a somewhat different appearance, and there is a profuse watery discharge from the nose and eyes. At first this discharge is thin, watery, and almost colorless in appearance. Later on it becomes more thick and of a yellowish color. In the majority of cases there is a loss of appetite, the bowels are somewhat constipated, and the flow of urine is less than normal. The urine passed may be of a high color and somewhat irritating.

When there is inflammation of the nose there is also frequently an accompanying inflammation of the mucous membrane of the larynx and bronchi. As a result, the animal will develop a sharp barking cough, which is especially noticeable when the hog comes out into the open air from a warm shed.

Treatment.—Preventive treatment of this condition consists in providing suitable sleeping quarters for the herd. Hogs should never be crowded into overheated, poorly ventilated sheds. Especially should the practice of allowing hogs to burrow around a straw-stack or manure pile be discontinued. The shed made by piling a straw-stack over a framework of posts should also be condemmed. Hogs need clean, dry, comfortable sleeping quarters, where they have plenty of room, plenty of light, and plenty of ventilation. While cold in the head is not of such great importance in itself, yet it is a dangerous condition, in that it lowers the vitality of the animal and opens the way for hog-cholera. In nearly every outbreak of hog-cholera in the winter months there is a preceding history of catarrh and cough.

The active medicinal treatment of the disease is simple. The animals should, first of all, be removed to suitable quarters where overcrowding and overheating may be avoided. The use of all forms of dusty food should be discontinued for several days, as dust irritates the inflamed membranes. Warm slops and bran mashes are the best food for these cases. Give plenty of water which is heated to a suitable degree to make it inviting. For the purpose of overcoming the constipation a mild cathartic should be given. The best remedies for this purpose are calomel and castor oil. In cases where the discharge from the nose is quite severe small doses of atropin or of tincture of belladonna may be given.

In the severe cases, where coughing and difficult breathing are marked symptoms, the animals should be steamed, using turpentine in about ½ of 1 per cent. solution. A shallow pan containing boiling water to which turpentine has been added should be held under the noses of the animals and allow them to inhale the steam.

MALIGNANT CATARRH

This is a form of inflammation of the nose which is produced by a specific germ known as the Bacillus pyocyaneus, and which is more severe than that just described.

This form of the disease occurs particularly in pigs and is very common in Germany. American veterinarians have made very little mention of the disease. It is especially common in pigs about three to six weeks old, and is not often seen in adult animals. The disease may occur at any season of the year, but is more common in the winter and spring. It is a contagious disease, and often spreads very rapidly through an entire herd.

The attack starts with a dulness and loss of appetite. This is followed by sneezing and the appearance of a blood-stained discharge from the nasal cavities. This discharge, at first bloody, later becomes of a yellowish, pus-like nature. The sick pigs become quite dull and stupid, and usually die in the course of a few days.

Treatment of this form of catarrh is very unsuccessful, and in the majority of cases the animals affected die. At the commencement of an outbreak the well animals should be separated from the sick and the pens disinfected with chlorinated lime or a cresol solution.

The only form of active treatment that has proved in the least successful is the irrigation of the nostrils with a solution of bichlorid of mercury. This is used in a solution containing about 4 gr. to the ounce. One teaspoonful of this solution is used for irrigation of each nostril. Inhalations of turpentine are also of value in relieving the condition.

SORE THROAT (ACUTE LARYNGITIS, LARYNGOPHARYNGITIS)

The larynx is the small box-like structure which forms the upper end of the respiratory tube and connects the nasal passages with the trachea and bronchial tubes. This structure is located in the

back part of the throat, just behind and below the root of the tongue. Lying right alongside the larynx is the upper end of the digestive tube, known as the pharynx. Just in front of these two structures the tonsils are to be found, one being located on either side of the entrance to the throat from the mouth. These three organs, lying as they do in close association with each other, are often all involved in any inflammation which may affect one or other of them. Accordingly, we find that when we have an inflammation of the larynx we are also likely to have an inflammation of the pharynx and perhaps also of the tonsil. Inflammation in any one or more of these organs is commonly called sore throat, as one of the most prominent symptoms is difficulty in swallowing.

Causes.—The causes for a laryngitis are very much the same as for cold in the head. Especially prominent as a cause for this condition is improper sleeping quarters. When animals are overcrowded in poorly ventilated sheds, or allowed to burrow under straw-stacks and around manure piles, overheating and diseases of the nose, throat, and lungs are sure to follow. The animal, coming out from an overheated bed, steaming and sweating, is rapidly chilled by the cold air of frosty mornings, and it is only a few hours until a severe cough announces that trouble has been started. The disease is, accordingly, much more common in cold weather, as this is the season for overcrowding and chilling.

Another frequent cause of inflammation of the larynx is the inhalation of impure dust and irritating chemical vapors. In animals that are fed on distillery mash the vapors of the alcohol contained in the mash may cause sore throat and cough. Frequently in giving drenches irritation of the larynx is produced and cough and sore throat follows. Wallowing in cold water when overheated is another cause for the trouble.

Sore throat is a very common complication of many of the acute infectious diseases, and especially so of hog-cholera.

Symptoms.—Cough is the all-important symptom in all forms of inflammation of the larynx and the surrounding structures. This cough is at first short, sharp, and dry in character. It is especially provoked when the animal comes out from an overheated shed into the open air. It is also brought on by exercise or by drinking cold water. It often occurs in spasmodic attacks, and, as

a rule, is quite painful. Later in the course of the disease the cough becomes more long-drawn-out in character, less sharp and irritating, and there is a discharge from the nose and mouth of a sticky sputum.

The animal is usually somewhat feverish; the eyes are red and watery in appearance, and the animal stands with the back somewhat arched, the tail drooping, and the flanks tucked up. Appetite is partially or completely lost, and the animal is constipated as a rule. The sick hog may attempt to eat, but is forced to quit on account of the pain which is caused by every effort at swallowing.

There is usually some difficulty in breathing, and the rate of breathing is usually increased. There may be some local swelling around the throat, and on examination of the neck it is found to be quite painful, and any pressure over the larynx brings on a fit of coughing. In the more severe septic cases false membranes form in the larynx and wind-pipe and the animal may die from suffocation. In laryngitis accompanying hog-cholera it is not infrequent for typical ulcers to form in the larynx as well as in the digestive tract.

In many cases, especially where animals are kept all winter in overcrowded and poorly ventilated sleeping quarters, the disease becomes chronic. In these cases there is a constant hacking cough, especially noticeable when the animals come out of their nests in the mornings; the appearance is very unthrifty, and the hog does not gain in weight. This lowering of the vitality of the animal may later on be followed by the development of hog-cholera.

Changes in Tissues.—In an acute case of laryngitis or pharyngo-laryngitis the lining membrane of the larynx and pharynx becomes reddened and congested. There is considerable swelling, and later in the course of the disease the membrane is covered over by a thick layer of mucus. In the severe septic types false membranes are formed or deep ulcers may be seen.

Treatment.—In the prevention of this condition the main point consists in providing the herd with suitable sleeping quarters, so arranged as to prevent overcrowding and overheating of the animals. Where this is done there will be but little sore throat, cold in the head, or other disease of the respiratory tract.

Active treatment in an acute case of laryngitis is quite similar

to that described for pharyngitis. The animals should, first of all, be removed to suitable quarters where overcrowding and overheating can be avoided. The food given should be largely of a warm, sloppy character, such as can be easily swallowed without pain to the animal.

In order to get the bowels and kidneys to working properly it is advisable to give a dose of 10 to 15 gr. of calomel, followed by a dose of about 4 ounces of castor oil. A little saltpeter or potassium nitrate added to the drinking-water will stimulate the kidneys and reduce any fever that may be present. The water should be suitably warmed, so that the animals may drink it without becoming chilled.

As local treatment an electuary, made up of syrup, meal, and ginger, containing aconite, belladonna, and chlorate of potash, is quite effective. Take 3 ounces of syrup, 2 drams of tincture of aconite, 1 dram of tincture of belladonna, and 2 drams of chlorate of potash, with a small amount of powdered ginger and meal enough to make a thick paste. This is to be smeared on the teeth in teaspoonful doses three times a day.

In those cases where a membrane forms, or where there is ulceration of the larynx, local swabbing of the throat with a 1 per cent. silver nitrate solution is effective.

Externally, some stimulating liniment, such as ammonia liniment, may be applied with benefit. In chronic cases it is often advisable to use a blistering application. For this purpose an ointment containing 1 dram of powdered cantharides to 1 ounce of lard is an effective agent.

In the chronic cases, proper quarters, plenty of clean, wholesome food, and the administration of some tonic mixture, such as gentian, iron, sodium bicarbonate, and powdered nux vomica, will result in a complete recovery in most instances.

BRONCHITIS (COLD IN CHEST, INFLAMMATION OF THE BRONCHIAL TUBES)

Definition.—Leading from the larynx to the lungs is the principal air tube, the trachea, or, as it is commonly called, the wind-pipe. In the chest this divides into two principal tubes, one of which passes to each lung. These break up into a number of smaller branches, which pass to the different divisions of the lung. These

branches of the trachea are known as the bronchi, and inflammation affecting the bronchi is known as bronchitis or cold in the chest.

Causes.—The causes of bronchitis are about the same as those for cold in the head and sore throat. As a matter of fact, the inflammations of the bronchi usually follow an attack of cold in the head or laryngitis. Exposure to cold northeast winds, especially when overheated, as when coming out of a steaming nest beneath straw-stacks or manure piles, is one of the most common causes of the disease. Accordingly, this disease is especially frequent during the winter and spring months.

Animals which are shipped in open stock cars during the winter months very often develop a severe bronchitis. Fat hogs are very easily overheated by running or driving, and as a result develop an inflammation of the bronchial tubes. Dipping of hogs in cold weather is another very common cause for the disease. Fluids entering the wind-pipe when drenching a sick hog may set up a very severe form of bronchitis.

As in the case of other diseases of the respiratory tract, this condition may be produced by inhalation of dust or of irritating chemical vapors. Another somewhat frequent cause of bronchitis is the presence of lung worms. Heart disease is usually complicated by the presence of a chronic form of bronchial inflammation.

Symptoms.—Bronchitis is ushered in by a loss of appetite, dulness, and a feverish condition. Cough is an early and pronounced symptom. This cough at first is of a short, dry character, but later becomes more moist, and is accompanied by a discharge of mucus from the nose and mouth. In the cases that are due to lung worms some of the parasites may be coughed up.

The breathing is somewhat rapid, and may be of rather a noisy character. The animal has an unthrifty appearance, has a tendency to remain hidden in its nest, and, if forced to move about, a spell of coughing is brought on. If the ear is placed on the chest wall, loud whistling sounds known as râles can be heard.

In the chronic form of bronchitis the principal symptom is the cough, which is especially noticeable when the animal comes out of its sleeping quarters in the mornings. The hog has a rather unthrifty appearance and does not gain in weight as it should.

Treatment.—Prevention of bronchitis, and especially of the chronic form of the disease, consists largely in providing proper sleeping quarters, which are so arranged as to prevent overcrowding and drafts. As previously recommended, keep hogs away from straw-stacks and manure piles, and have them sleep in well-ventilated sheds, where plenty of light and fresh air can be had and where overheating and piling up will be impossible.

In the active treatment of the disease it is important to have the animals removed to suitable quarters, which shall be warm, comfortable, light, and well ventilated. The food should be of the light, sloppy character recommended in treatment of laryngitis. A mild cathartic of calomel and oil should be administered to overcome constipation. Plenty of water of a comfortable temperature should be provided.

In cases that are severe, and in which the cough is troublesome, steaming with turpentine or other similar substance is efficient treatment. An electuary similar to that advised for laryngitis is very effective in relieving the cough, fever, and difficult breathing.

The disease usually runs a mild course, and if the hygienic conditions are corrected and suitable sleeping quarters provided, a prompt recovery is the rule, even without any medication.

In chronic cases the main element in treatment is to make necessary changes in sleeping quarters so as to give the animals plenty of air and prevent overcrowding and overheating. Food should be given that is easily digested, and a tonic powder similar to the hog-cholera preparation should be given for a few weeks once or twice daily.

PNEUMONIA (INFLAMMATION OF THE LUNGS)

Pneumonia is a disease in which the tissue of the lung itself is the seat of an inflammation. There are two principal types of pneumonia, one in which an entire lobe of the lung is involved, and which is known as lobar pneumonia, and another in which scattered areas here and there throughout both lungs are involved, and which is known as bronchopneumonia. This last class of pneumonia is really a capillary bronchitis, and is not common in the hog.

Causes.—The causes of pneumonia are quite similar to those of bronchitis and other forms of inflammation of the respiratory

passages. It is a disease which may occur at any season of the year, but is especially common in the winter and spring. It is much more common in fat, plethoric animals than it is in the lank, thin hogs. Overcrowding and overheating, followed by exposure to cold rainy weather, is a most fruitful cause for pneumonia. Animals coming out of a hot nest into the raw bleak winds that prevail in March and April are especially likely to develop bronchitis or pneumonia.

Pneumonia is especially common in animals that have been suddenly changed from sanitary quarters to a drafty, ill-ventilated shed. This is very commonly seen in the winter months, when hogs are purchased at a public sale and moved to a neighboring farm and placed in a pen where they are overcrowded and liable to become overheated. The home herd that is used to this mismanagement may not be affected, as they have become gradually accustomed to it. The newly purchased animals are unable to stand the sudden change and often develop a fatal pneumonia and die. In like manner, shipping of animals in open stock cars in the winter months is often followed by pneumonia.

Hogs not infrequently develop a pneumonia as a result of chilling after passing through a dipping vat. Inhaling of irritating gases and vapors is another common cause of the disease. Unskilful drenching, resulting in the passage of the fluid down the windpipe rather than the food passages, is also liable to be followed by pneumonia.

Pneumonia is a very common complication of other diseases in swine. This is especially true in hog-cholera and in swine plague. Hog-cholera is complicated by a pneumonia in perhaps 50 per cent. of cases. What was formerly known as swine plague is, in reality, hog-cholera with a complicating pneumonia. Lung worms also frequently set up small areas of pneumonia in the lungs. This form of pneumonia is more common in Europe than in the United States.

The specific cause of pneumonia is a small germ which is known under the name of the pneumococcus. It is a small lancet-shaped organism, and is found in the nose and throat of healthy animals. It is unable to produce disease unless the resistance of the animal be lowered in some manner, as by exposure to chilling winds. This

gives the germ a chance to secure a foothold, and inflammation of the lungs is the result.

Symptoms.—Pneumonia may be preceded for a few days by the symptoms of a bronchitis and sore throat. This is especially likely to be the case in bronchopneumonia. In the true lobar pneumonia, however, there are rarely any warning symptoms, and the disease starts suddenly and violently. The onset is with a severe chill in most cases. The temperature rises very rapidly after this chill and the animal becomes very sick. In some cases death follows within a few hours, and the animal may be dead before the owner even notices that there has been anything wrong.

In the cases that run a little longer course there is loss of appetite, marked dulness following the initial chill, and rise in temperature. The animal stays in the nest and lies on the belly or on the affected side. Breathing is rapid and shallow and apparently painful. The animal has an anxious expression, and it is easy to see that it is severely ill. Cough becomes an early symptom, and is of a dry, harsh character at first, later becoming more moist and accompanied by a discharge from the nose. This nasal discharge is often streaked with blood, and in some cases there may be considerable bleeding from the nose. The lining membrane of the nose and mouth is congested and dry in appearance.

The pulse is rapid and strong early in the disease. Later on it becomes very weak, and just before death it may be impossible to feel the pulse. The increase in rate of the pulse is not in proportion to the increase in the rate of breathing, and in severe cases the breathing may be as rapid as the pulse.

Pneumonia has a peculiar tendency to end by crisis in those animals which recover. At this time all the symptoms suddenly become less severe, the temperature falls, and the animal makes a decided change for the better in a very few hours.

During the course of a pneumonia, examination of the chest, by placing the ear over the ribs, is of considerable value, especially if the animal is not too fat. In very fat animals the chest wall is so thick that it is impossible to hear very distinctly any sounds from the lungs.

Where it is possible to hear the sounds from within the chest early in pneumonia a peculiar suppressed breath murmur is heard.

Later this is replaced by a harsh, grating sound, and after the lung has become solid by the throwing out of an exudate into the air spaces a very loud tubular breathing can be heard. This loud tubular sound is very much different from any other sound heard over the lung in disease, and is highly diagnostic to the trained observer. Later in the disease, after the crisis has occurred, gurgling râles can be heard, indicating that the exudate is softening up and being removed. These sounds over the chest are of great importance in watching the course of the disease.

Postmortem Diagnosis.—In hogs that die of pneumonia the postmortem findings are quite characteristic. If we open the body of the dead animal the important changes will be found in the organs of the chest cavity. The affected lung will be found to have lost its normal elastic, sponge-like consistency, and instead will be found to be solid, very much resembling liver. On account of this resemblance to liver tissue the lungs are said to be hepatized. The color of the affected lung will vary somewhat with the stage of the disease process. If the animal dies soon after the chill the lung will be found to be bright-red in color and enormously congested with blood. Later on in the disease this bright-red color changes to a chocolate brown, and about the time of the crisis it is changed to a yellowish-gray color, due to the invasion of the diseased areas by white blood-cells. The lung is much heavier than normal, and a portion of it is cut off and placed in water will sink to the bottom of the glass. Healthy lung tissue will float in water.

It is sometimes a question as to whether the disease present is pneumonia or hog-cholera. This is sometimes very hard to decide. As has already been stated, pneumonia is a very frequent complication of hog-cholera, and in many cases the postmortem signs are almost entirely those of pneumonia. The history will be of some importance. If cholera is in the vicinity, suspicion should always be aroused. In cholera there will usually be some other signs of the disease, either turkey-egg spotting of the kidney, ulcers in the bowel, spots on the skin, hemorrhages into the lymph-glands, or mottling of the surface of the lungs with bright red spots. However, there will be some cases in which the diagnosis will be impossible without observing the further course of the disease. In

any case, where there is reasonable possibility of hog-cholera, inject the serum in the entire herd.

Treatment.—Prevention of pneumonia consists in avoiding those things which have been given as causes for the disease. Again we have the importance of avoiding drafty, unhygienic quarters. Especially must care be exercised in the case of new animals brought upon the place during the fall and winter months. These are the animals that are particularly liable to contract pneumonia unless they be placed in comfortable quarters. As has already been frequently mentioned, swine must not be allowed to burrow under manure piles and straw-stacks during the winter months and be expected to keep well.

In the handling of a case of pneumonia proper care of the animal is of even more importance than medicine. The sick hog should be removed to a clean, warm box-stall, if available, and given plenty of bedding in which to make himself comfortable. In order to further ensure warmth and comfort a blanket may be put over the sick animal. Plenty of fresh air and sunlight should be admitted to the stall, as air and sunshine are very important aids in the treatment.

The food should be of the soft, sloppy variety. Bran mashes and other soft, easily digested foods should be offered and should be warm when given. No dry food should be given for at least two weeks after complete recovery. To clean out the bowels and restore normal digestion a dose of calomel and oil should be given, and the oil should be repeated every other day for three or four doses. Plenty of water from which the chill has been removed should be given. Potassium nitrate may be added with advantage, as it will stimulate the kidneys, increase the flow of urine, and reduce the fever.

In pneumonia the most frequent cause of death is heart failure, and this is the complication that must be most guarded against in the treatment. For this purpose digitalis should be administered in doses of about 15 drops of the tincture every three hours. Strychnin and whisky also serve a good purpose in supporting the heart. Strychnin may be given in large hogs in doses of $\frac{1}{4}$ to $\frac{1}{2}$ gr. in a tablespoonful of whisky every three or four hours.

INFECTIOUS PNEUMONIA

A few years ago, during an outbreak of disease among swine in northwestern Missouri and southwestern Iowa, Dr. Kinsley and other veterinarians reported what they believed to be a contagious form of pneumonia. This disease did not seem to have the characteristics of either pneumonia or hog-cholera, and seemed to them to be a new disease.

Investigations made by veterinarians connected with the United States Bureau of Animal Industry Station at Ames, Iowa, demonstrated that the disease in question was really hog-cholera. Blood from the diseased animals, taken to the station at Ames and injected into healthy pigs, produced typical symptoms and post-mortem findings of hog-cholera.

From these findings we must conclude that a contagious pneumonia does not exist as a separate and distinct disease. This case does illustrate, however, the frequency with which even experts may be deceived as to diagnosis between pneumonia and hog-cholera.

PLEURISY

Definition.—The pleura is the bright, shiny serous membrane which lines the inner surface of the chest and is reflected over the lungs. Inflammation of this membrane is known as pleurisy. It is commonly seen in combination with pneumonia, and the combination of the two diseases is sometimes referred to under the name of pleuropneumonia.

Causes.—The causes of pleurisy do not markedly differ from those of pneumonia. Poorly ventilated, drafty pens are especially liable to produce inflammation of the pleura. Exposure to cold wet weather is another very fruitful cause. Injuries to the chest wall are perhaps the most common cause in the hog. A kick from a horse or steer, or being tramped on by one of the larger animals, is especially liable to produce a pleurisy.

Pleurisy is commonly met with as a complication of such diseases as hog-cholera and tuberculosis. The disease may be of either an acute or chronic type. More commonly it is of the acute type.

Symptoms.—The disease usually starts in with a chill or a number of repeated light chills. The temperature rises somewhat, but

not as high as in pneumonia. The animal becomes dull, loses appetite, and all desire to move about. When forced to rise from the nest and move around, the sick hog moves very slowly and stiffly, and is likely to show marked lameness in the front feet.

Breathing in this case is very peculiar. There is practically no movement of the ribs and muscles of the chest, and the breathing is done entirely with the muscles of the flank. The breathing is of a short, jerky character and quite rapid. If any effort is made to examine the animal we find marked signs of pain in the side. An effort to press over the ribs of the affected side will cause the animal to flinch and grunt or even squeal with pain. This is especially noticeable early in the disease.

A little later in the course of the disease a fluid is poured out into the cavity of the chest between the layers of the pleura, and then the pain becomes less marked and the muscles of the chest are again used in breathing. The pressure of the fluid upon the lungs makes breathing very difficult, however, and the animal produces a grunting sound at each breath. As the disease clears up the pain again returns, the ribs are again held rigid, and the jerky abdominal breathing is seen.

During the early stages of pleurisy, if the ear be placed over the ribs, a very peculiar and characteristic noise is often heard. This is a grating or rubbing sound, produced by the grating of the inflamed surfaces of the pleura upon each other. It sounds very much like rubbing two pieces of sand-paper together, and is a very important point in the diagnosis of the condition. When the fluid is poured into the pleural sac this grating sound disappears, and we have it replaced by an absolute absence of sound. There may be some bulging of the spaces between the ribs at this time. Later in the condition, when the fluid is absorbed, the grating sound may return.

In the chronic form of pleurisy the animal becomes run down, loses flesh and strength, and often will be found to remain lying in the litter and refuses to get up and move about. If forced to get up and walk the animal is found to be very weak. In some cases the disease spreads to the heart or lungs and results in death.

Anatomic Changes.—The changes which occur in appearance of the pleura in the course of this disease are very interesting, and give us a clear understanding of the variation which takes place in

the symptoms. Early in the disease the membrane is inflamed and congested. At this time it is bright red in appearance and rough on its surface. The rubbing together of the two layers of this roughened organ is what produces the grating sound above referred to. A little later on fluid passes out from these engorged blood-vessels and separates the two inflamed pleural surfaces. This is what causes the disappearance of the friction sound and the increased difficulty in breathing. Later on, this fluid is again absorbed and the inflamed surfaces again come in contact. This is the time when the friction sound is again heard.

In some of the chronic cases fibrous bands form between the two layers of the pleura and cause permanent interference with breathing.

Course.—The course of the acute form of pleurisy is one to two weeks. In the chronic form of the disease the course may be quite long-drawn-out and last several weeks or months.

Prognosis.—The outlook in pleurisy is not very good. A large number of cases die. However, I am convinced, by the frequency with which healed pleurisy is met with on postmortem in the large packing houses, that many cases of this disease pass unnoticed by the owner and recover. With proper treatment the prognosis in this disease should be fairly good.

Treatment.—As in pneumonia and other diseases of the respiratory tract, the preventive treatment in this disease consists largely in the providing of proper quarters for the herd during winter weather and protecting them from drafts and exposure. The importance of preventing overcrowding and overheating has already been emphasized many times, and is equally important in connection with pneumonia as in other diseases of the respiratory tract.

In the case of the sick animal it is important that it be placed in comfortable surroundings and protected from drafts and exposure. A good, clean, warm box-stall makes about the best obtainable quarters. Plenty of bedding should be provided, and the animal can be further protected by a blanket, as in the case of pneumonia. Hot applications of various sorts may be made to the chest wall to promote comfort.

In the way of internal medication it is well to start with a purge

of the calomel and castor oil. This may be accompanied or followed by the administration of small doses of aconite and bryonia. About 5 drops of tincture of aconite and 2 drops of specific medicine bryonia (Lloyd Bros. preparation) should be administered every two hours. For the relief of pain and the control of the inflammation no agents are more effective than these two.

To the water provided for drinking purposes it is well to add a small amount of nitrate of potash, to stimulate the action of the kidneys. By increasing the action of bowels and kidneys the absorption of the fluid in the pleural sacs is hastened.

After the acute symptoms have subsided, it is advisable to keep the animal for several weeks in warm quarters and fed on soft food, to which a tonic condition powder, similar to those already mentioned, has been added.

DISEASES OF KIDNEY AND BLADDER

HEMATURIA (BLOOD IN THE URINE)

BLOOD may appear in the urine as a result of severe inflammation affecting any portion of the urinary tract. In severe inflammation of the kidney itself, as in the acute nephritis of hog-cholera, there may be the appearance of a blood-stained urine. Inflammation of the bladder is also accompanied in many cases by the appearance of blood in the urine.

Blood may appear in the urine for several days after a severe injury in the region of the kidneys, as after being trampled by one of the larger animals or being run over with a wagon. Parasitic diseases of the kidney may also cause the appearance of blood in the urine. Kidney and bladder stone produce severe irritation of the kidney and bladder and may result in a blood-stained urine.

Symptoms.—The important symptom of blood in the urine is the more or less red color of the urine. Clots of coagulated blood may be found, and when the urine is collected in a glass and allowed to stand there is a collection of a reddish-colored sediment at the botton of the glass. Accompanying the presence of the blood-colored urine there is noted the symptoms of the underlying disease.

Treatment.—The treatment of blood in the urine is entirely that of the condition which caused the appearance of the blood. No particular remedy is indicated for the hematuria. When the underlying disease is removed the bloody urine disappears.

ACUTE NEPHRITIS (INFLAMMATION OF THE KIDNEYS)

Acute inflammation of the kidneys is not uncommon in the hog as well as the other domestic animals. In the hog the symptoms are usually somewhat masked, and, for this reason, the condition probably escapes notice very frequently.

Causes.—The most common cause for acute nephritis in the hog is probably injury to the back. Fat hogs are especially liable

to be trampled upon in feed lots or may be accidentally caught under a wagon. Where the herd is allowed to pile up in overcrowded sleeping pens the back often becomes injured, and an acute inflammation of the kidney is the result.

Exposure to cold, damp weather, especially if the animals are overheated, is often followed by a nephritis. Dipping animals while overheated or in cold weather may result in the production of this disease. Another cause for the disease is the ingestion of irritating chemical substances. This may occur as a result of various chemical compounds contained in kitchen slop, or as a result of drinking solutions of carbolic acid or bichlorid of mercury thrown upon the ground.

Primary cases of acute nephritis are not nearly so frequent in the hog as the secondary inflammation, seen as a complication of acute infectious diseases. Practically every case of hog-cholera is complicated by an acute inflammation of the kidneys. So often is this the case that we have already seen how the hemorrhagic spotting of the kidneys is one of the most positive postmortem signs of cholera. Acute nephritis is also seen with great frequency in other acute diseases, such as pneumonia, pleurisy, and severe inflammation of the bowels.

Symptoms.—In the cases that are due to hog-cholera and the other acute infectious diseases there are no distinct symptoms of the kidney inflammation, and this part of the trouble is usually entirely masked by the symptoms of the primary disease.

In a primary nephritis, coming on as the result of an injury or exposure to cold and wet, the symptoms at first are not very severe. The animal becomes somewhat dull, loses appetite and desire to move about, and will lie in the nest most of the time. When forced to move about the gait is slow and of a peculiar straddling nature. The evidences of pain in the back may be very noticeable, and the animal may be unable to bear weight on the hind limbs. The sick hog will usually stand with the hind feet well up under the body, the back arched, and the flanks drawn up.

The amount of urine passed is quite small, and is passed at frequent intervals. The color of the urine is much darker than normal, and in severe cases is of a smoky or even blood-red color. The more severe the inflammation, the more marked are the changes

in the urine. In some very severe cases the urinary flow is entirely stopped.

The temperature is usually increased, and in well-marked cases there may be a fever temperature of 105° F. The respirations are usually quickened, and are largely thoracic in character, the abdominal muscles being moved as little as possible. If an attempt is made to examine the animal it will be found that there is exceedingly well-marked tenderness over the region of the loins.

Fig. 86.—Acute parenchymatous nephritis (catarrhal): *a*, Tubule denuded of a large part of its epithelium; *b*, cells in a condition of degeneration; *c*, mass of desquamated cells in a tubule (McFarland).

Dropsy sometimes occurs, but less often in the hog than in the horse. In prolonged cases there is often an accumulation in the body of poisonous substances that should pass out through the kidney, and, as a result of irritation by these toxic materials on the nervous system, convulsions often occur.

Postmortem Findings.—In an animal that has died of acute inflammation of the kidney the postmortem lesions are quite characteristic. As a rule, the kidneys are enlarged in size, are of a reddish color, and may show small pin-point, bright red spots on their surface. This is especially true in those cases that are due to

hog-cholera. The kidney is softer than normal and engorged with blood. When cut into, the organ drips blood, and many small red points can be seen on the surface. When cut into, the pelvis of the kidney is frequently found to be filled with a thick, highly colored urine, and there may be considerable fluid under the capsule.

Treatment.—The prevention of this disease consists principally in care to avoid overcrowding and exposure to cold air and drafts. Every possible care should be used to limit the danger of injury in the feed lots. Running of animals by boys or dogs should also be stopped.

In the active medicinal treatment of this disease a warm, comfortable stall should be provided for the sick animal and every effort made to keep it warm and comfortable. Hot poultices of flaxseed or other suitable agents can be applied over the region of the loins with benefit. The diet is the next most important point in the treatment of the disease. The best plan is to shut off all forms of solid food and place the animal on milk alone, or milk with the addition of a small amount of some soft, warm, sloppy food. Plenty of water should also be supplied the sick animal, and to this small amounts of potassium acetate or potassium nitrate should be added for their mild stimulating action upon the kidney. Linseed tea is also a soothing and stimulating agent for this purpose.

To aid elimination of poisonous substances as much as possible through other parts of the body, and thus relieve the kidney of a large amount of work, cathartics should be given, the best agents for this purpose being calomel, castor oil, and Epsom salt. Unfortunately in the hog we are unable to accomplish anything in the way of promoting elimination through the skin, as the hog is a very difficult animal to sweat.

In some cases the heart will be found to be very weak, and in these cases whisky, digitalis, and strychnin should be given as recommended in the treatment of pneumonia. During convalescence from the disease it is well to keep the animals on sloppy food, keep them in warm, comfortable quarters, and administer some of the hog-cholera tonic mixture or similar tonic condition powder until they have fully regained strength.

Acute nephritis, occurring as a result of injury to the back, need not necessarily be fatal, and should respond to treatment; however,

in these cases if the animal is seen immediately after the injury, and it appears to be severe, the best method of handling the case is immediate slaughter for food purposes before any germ infection or inflammation sets in. This will be found to be the more profitable practice in the majority of cases, except in pure-bred animals, where the value for breeding purposes must be considered.

CHRONIC NEPHRITIS

The chronic form of inflammation of the kidney, which is quite common in man and in the horse, is very rare in the hog. This is probably explained by the fact that the hog lives only a few years, and does not have a chance for the slow development of a disease, such as chronic nephritis.

This form of disease may, however, follow after an incompletely recovered attack of the acute form. The symptoms are principally the passage of a large amount of pale-colored urine, together with considerable thirst, loss of appetite, loss of weight, and a general unthrifty appearance. The sick animal becomes stupid, sluggish, and loses strength and ambition. The heart usually becomes weak, and the accumulation of poisonous substances in the body as a result of faulty elimination from the kidney often produces convulsions and, finally, death.

Treatment for chronic nephritis is of no avail, and the animal gradually loses weight and strength until death carries it away. If the body of the animal be opened after death the kidneys will usually be found to be considerably shrunken in size, quite firm to the touch, and, if cut into, there will be seen a large amount of tough fibrous connective tissue replacing the normal tissue of the kidney.

RENAL DROPSY (HYDRONEPHROSIS, CYSTIC KIDNEY)

Cystic disease of the kidney is a condition which is very commonly met with in hogs during meat inspection. Lucks reports finding the condition in 43 (0.67 per cent.) out of 6425 hogs examined. In female pigs it was found almost three times as frequently as in males. In 29 cases the condition was only on one side (ten times on the left side, nineteen times on the right side). In 14 cases both kidneys were affected.

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Cause.—The active cause of cystic kidney is some obstruction to the flow of urine. The block may be on one side or on both. The kidney continues to secrete urine, and the fluid, if unable to pass down as it should to the bladder, will dam back into the kidney, dilate the urinary passages, and destroy the normal tissues of

Fig. 87.—Congenital cysts of the kidney: *a*, Renal artery; *b*, renal vein; *c*, ureter; *d*, pelvis of the kidney; *e*, cysts filled with clear fluid (McFarland).

the kidney. The organ then becomes simply a dilated sac containing the dammed-back urine.

Careful investigations in hogs have proved that the most frequent cause of the condition is the fact that the ureters or tubes leading from the kidney to the bladder are placed very low down at their point of entrance into the bladder. As a result, when the

bladder becomes partially filled with urine it presses down upon the openings of these tubes and chokes them off. In this way the flow of urine from the kidney to the bladder is checked and the dammed-back urine dilates and atrophies the kidney.

Symptoms.—The symptoms of this condition in the living animal are usually unnoticeable. One kidney may be very extensively affected without producing any symptoms whatever. The opposite organ simply enlarges and compensates for the function of the destroyed kidney. If both kidneys are affected there will be noted a marked decrease in the amount of urine passed, and, as a result of the failure to eliminate the poisonous material that should pass out with the urine, convulsions and other toxic symptoms may be developed.

Occasionally the diseased kidney becomes so large as to cause a noticeable swelling of the belly, and if an exploratory puncture is made into this tumor-like mass a urinous fluid is obtained. In hogs the condition is usually first noted on postmortem inspection.

Treatment.—There is no treatment that can be of any benefit in this condition in the hog. As a rule, no disturbance is noticed during the life of the animal.

RETENTION OF URINE

By retention of urine is meant a condition in which it is impossible for the animal to pass the urine. This may be due to a number of causes.

Causes.—The cause for retention of urine may be a paralysis of the muscle of the bladder, making it impossible for that organ to contract and force out the urine. Another not infrequent cause is a spasm of the muscle which guards the opening of the bladder. This is known as spasm of the sphincter muscle of the bladder. Another cause is the presence of stones or other obstructions in the ureters or tubes leading from the kidney to the bladder. In like manner, there may be obstruction to the escape of urine from the bladder, as by lodgment of a calculus or stone in the urethra. Swellings of the sheath may also so close the opening of the penis as to make the escape of urine impossible. Abscesses or tumors in the region of the sheath may also cause retention of urine. Retention of urine not infrequently is noted following farrowing. In-

juries of the back are often followed by a retention of urine, especially if these injuries be well back in the neighborhood of the hips.

Symptoms.—The one important symptom is the inability of the animal to pass the urine. The bladder becomes distended and the animal very restless. Frequent efforts are made to urinate, but, in spite of forcible straining efforts, only very small amounts of fluid are passed. This usually comes in the form of a thin stream and is in very small amount. In some of the more severe cases no urine whatever is passed.

After a few hours stretching of the bladder becomes so severe that the sphincter muscle is paralyzed, and then the urine dribbles away in a fine stream. If the animal is examined, the swollen outline of the bladder can be made out, and pressure upon it causes the urine to flow out in a stream. If the catheter be introduced into the bladder a large amount of urine can be drawn off.

General symptoms are usually seen in retention of urine. The animal loses appetite, becomes restless, and remains apart from the rest of the herd. The animal will lie down for a while, and then get up to make straining efforts to pass urine. If not relieved, the bladder may stretch to the point where it will rupture into the peritoneal cavity, and the sick hog then develops symptoms of peritonitis and dies.

Treatment.—In order to relieve the urgent symptoms the bladder must be emptied. This may be done by pressure over the distended organ, carefully made, or may be accomplished by passage of a small rubber catheter into the bladder. This is very easy in the sow, more difficult in the barrow. In cases that are accompanied by considerable restlessness small doses of tincture of opium may be given. Injections of hot water into the rectum are often sufficient to relieve the spasm of the bladder and enable the animal to pass the urine of its own accord. Where tumors or abscesses of the sheath are pressing upon the urethra and causing obstruction the only permanent relief obtainable is by surgical removal of these tumors and abscesses. This should be done at once.

In cases due to muscular spasm the animal should be placed in a warm, comfortable stall for a few days, and fed on a warm, sloppy diet until the bladder function returns to normal.

INFLAMMATION OF THE BLADDER (CYSTITIS)

Inflammation of the urinary bladder, or cystitis, is a rather uncommon disease in the hog, as compared with the other domestic animals.

Causes.—Cystitis may frequently result from retention of urine, the condition just described. When the urine remains in the bladder beyond a normal length of time it has a tendency to decompose and form irritating ammonia substances, which set up an inflammation of the lining membrane of the organ. In like manner, the presence of stones in the bladder produce an irritation which is very favorable to the development of an infection of the bladder wall.

Inflammation of the bladder may result as a secondary condition in the various acute infectious diseases. In nearly every case of severe acute hog-cholera some inflammation of the bladder is noticeable. In like manner, inflammation affecting the uterus or the large intestine may spread to and involve the bladder. Exposure to cold and wet act as predisposing causes, in that they lower the resistance of the animal and make conditions more favorable for the development of infection.

Overdoses of some of the irritating drugs, especially turpentine, may be followed by an inflammation of the bladder.

Symptoms.—The most prominent symptom in inflammation of the bladder is the frequent and painful attempts to urinate. The animal almost constantly tries to pass urine, and each attempt is accompanied by a great amount of pain. Practically no urine or, at most, a very small amount is passed. What little urine is passed is of a very dirty, cloudy appearance and has a strong odor.

In boars the reflex irritation causes an erection of the penis and the testicles may be drawn up. Colicky pain is also a quite pronounced symptom. The animal loses appetite, and in severe inflammation of the bladder shows a considerable amount of fever. The bowels are constipated, appetite is lost, and the animal walks with a stiff, straddling gait. If an attempt is made to examine the sick pig it will be found that there is most severe pain and tenderness over the region of the bladder. This organ, however, is empty instead of being distended, as in the case of retention of the urine.

Treatment.—Cystitis is rarely a serious condition in the hog, and rest in warm, comfortable quarters, together with proper regu-

lation of diet, is often all that is necessary to produce complete recovery in a week or ten days. The animal should be confined to a warm, well-bedded box-stall, and placed on a sloppy diet, with plenty of water. For the purpose of relieving the irritability of the bladder small doses of tincture of opium may be given or, better still, specific medicine salix nigra. This is the most effective agent in the entire Materia Medica for relief of irritation of the bladder and urinary apparatus. The best preparation is the specific medicine put up by Lloyd Bros., of Cincinnati. Given in doses of ½ teaspoonful every three hours, it will quickly relieve the straining attempts at urination and the burning sensations which accompany them.

Some of the urinary antiseptics are also valuable, the most efficient perhaps being salol. This should be given in doses of about 10 to 15 gr. Much benefit can be obtained by thoroughly emptying the bowels with a dose of calomel and castor oil and Epsom salt.

The animals should have plenty of water, and should be kept on the sloppy diet for at least a week after the acute symptoms have disappeared. A tonic condition powder can also be given with benefit after the severe attack is over, to hasten complete recovery.

DISEASES OF HEART

ACUTE INFLAMMATION OF THE HEART

In the hog the most common causes of acute diseases of the heart are the infectious diseases, especially pneumonia and hog-cholera. Hog-cholera is especially liable to be complicated by disease of the heart. These diseases of the heart may take the form of an inflammation of the outer covering of the organ (pericarditis); an inflammation of the inner lining of the heart (endocarditis); or there may be an inflammation of the muscular substance of the heart itself (myocarditis).

Symptoms.—In the hog it is very seldom that a diagnosis of heart disease can be made. The diseases of the heart do not often occur as primary diseases, and when they occur in connection with such diseases as hog-cholera, pneumonia, pleurisy, or rheumatism the symptoms of the principal disease are so prominent as to entirely overshadow the symptoms due to the disease of the heart itself.

Among the more important indications of involvement of the heart are rapid, feeble pulse, with irregularity of the beat. With a severe myocarditis the pulse often becomes so weak and irregular as to be imperceptible to the examining finger. With a pericarditis the pulse becomes very irregular. In this disease, if the ear be placed at the chest wall early in the condition, a peculiar grating sound, very similar to that heard in pleurisy, may be detected, but in this case it differs from that seen in inflammation of the pleura, in that it occurs at each beat of the heart instead of with each inspiration.

In the acute infectious diseases when the heart is involved there is also a marked rise in temperature, the rise being much higher than in those cases where there is no heart complications. Heart disease is always associated with a certain amount of pain, and this makes the animal restless.

In chronic heart disease there is some difficulty in breathing, and the animal frequently develops a chronic cough. In this form of heart disease dropsy may also occur as a prominent symptom.

Treatment.—Rest is the all-important factor in the treatment of diseases of the heart. The animal should be placed in a warm pen, well bedded, and kept quiet. The pen should be kept somewhat darkened in order to encourage rest. Food should be of a soft

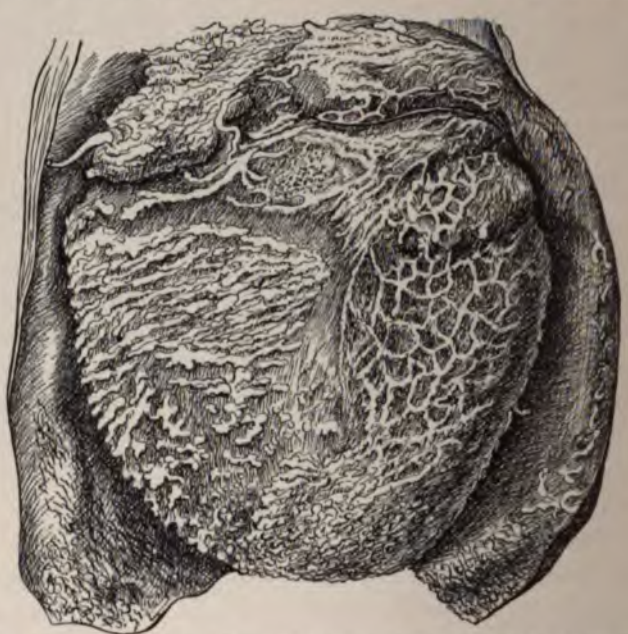

Fig. 88.—Fibrinous pericarditis; pericardium turned back to show the surface of the heart covered with fibrinous formation (Orth).

character, and plenty of water is to be given. Open up the bowels with a brisk cathartic, such as calomel, in doses of 10 to 15 gr., followed by the usual dose of castor oil or Epsom salt. The animal should have plenty of water, to which mild doses of potassium acetate or potassium nitrate may well be added.

To encourage quiet the animal should be given teaspoonful doses of tincture of opium every three or four hours. It is impossible to give any remedies that will act directly upon the disease process in the heart itself. In most cases it is important to treat

the underlying disease, such as rheumatism, pleurisy, pneumonia, or hog-cholera. If the disease which is causing the trouble be relieved, the heart will usually clear up of its own accord with a few days of rest and light diet.

In cases of myocarditis complicating pneumonia, and in which the animal is threatened with acute heart failure, the administration of 15-drop doses of tincture of digitalis and $\frac{1}{4}$-gr. doses of strychnin, with a tablespoonful of whisky every two hours, is indicated. Blistering liniments applied to the chest wall over the region of the heart may prove beneficial in some cases. For this purpose a liniment, consisting of equal parts of ammonia-water and cotton-seed oil, is quite useful.

FATTY HEART (FATTY DEGENERATION OF HEART)

Causes.—Fatty degeneration of the heart muscles is a condition which results from overfeeding and lack of exercise. It is especially liable to occur in pure-bred animals that are being too rapidly crowded in order to get a rapid growth and fattening for show purposes. In such cases there is an accumulation of fat in large masses around the heart, and the fat finally is deposited between the cells of the heart muscles and pushes them apart. In many cases the fat even seems to replace the muscle cells, and in this manner the heart is very much weakened.

Symptoms.—There are no prominent symptoms of this disease beyond the fact that the animal is very easily winded, and the least exertion brings on an attack of rapid, difficult breathing. In many cases the animal drops dead after any rapid exercise, as running by dogs or by the owner in an attempt to load the animal for shipment. Where fat hogs are driven to market it is not unusual for one or more of them to drop dead by the roadside as a result of this fatty degeneration of the heart, causing that organ to give out upon this unusual exertion.

In some of the more advanced cases rapid irregular heart action may be noticed even when the animal is at rest, and when examined the pulse is found to be rapid, weak, and irregular.

Treatment consists in avoiding this overcrowding of the herd beyond reasonable limits. Where animals are intended for immediate sale and slaughter the condition is of little importance if

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tation by rail for considerable distances. The condition here is also, no doubt, due to nervous excitement.

Symptoms.—The symptoms of the condition are sometimes not very noticeable unless the animals are closely observed. The most prominent symptom is the rapid, violent beating of the heart. In many cases the heart will be seen to beat at double its normal rate. In some of the severe cases this rapid beating is accompanied by a loud thumping sound, and the heart-beats can be heard at a considerable distance from the animal. In many cases the thumping of the heart against the chest wall can be plainly seen, and in more severe attacks the entire body may jerk at each heart-beat. These are the cases that resemble very closely spasm of the diaphragm or thumps. They differ from thumps, however, in that the jerking occurs with each heart-beat instead of with each respiratory movement.

During the attack the animal is quite restless and has a very anxious expression. In horses and in cattle it is common for the animals to break out in a sweat. This does not occur in the hog.

Course.—The course of palpitation is usually short, lasting only a few hours, or a day or two at most. Attacks may recur, however, at quite frequent intervals.

Treatment.—An attack of true palpitation of the heart requires but little treatment beyond absolute rest. Regulation of diet is also an important factor. The animals should be placed on easily digested, sloppy feed, and given a free dose of calomel and oil, for the purpose of cleaning out the stomach and bowel and removing any irritating substances which may be contained in these organs. For the irritability and restlessness teaspoonful doses of tincture of opium may be given for three or four doses at three-hour intervals.

DISEASES OF SKIN

REDDENING OF SKIN (ERYTHEMA)

Definition.—By the term "erythema" is meant a simple reddening of the skin due to the overfilling of the capillary blood-vessels in the deeper layers of the skin. It is not accompanied by any actual change in tissue structure, and is, in reality, the first step in the production of an inflammation of the skin. The condition occurs with sufficient frequency as a simple disease without being followed by tissue changes to deserve separate mention.

Causes.—Erythema may occur as the result of the application of irritating substances to the skin, such as strong blistering liniments. Thermal irritation is also a frequent cause for erythema, as from frost-bites, the rays of the sun, scalding, or burning. Erythema may also result from injuries to the skin, as, for instance, the irritation produced by crawling through or under a board fence. Bites and stings of wasps, bees, and other poisonous insects may cause a simple erythema.

Erythema is seen as an almost constant lesion in hog-cholera and also in swine erysipeals. In hog-cholera the erythema is often very marked and causes a reddening of almost the entire skin. It is especially noticeable on the skin of the ears, the flanks, the belly, and under the neck. Erythema may frequently be seen as a symptom of acute indigestion or after feeding upon spoiled fodder, distillers' mash, and other foods which have an irritating effect upon the skin. In these cases the reddening of the skin is due to the absorption of a poisonous substance from the bowels which especially affects the smaller blood-vessels.

Symptoms.—The characteristic symptom of the disease is a diffuse redness of the skin. The disease is much more easily detected in white hogs, but may be hard to make out in black animals, except in certain parts of the body where the skin is very thin. It is typical of the redness of erythema that if the reddened areas

are pressed upon with the finger the bright-red color disappears, and returns again as soon as the finger is removed.

Course.—Erythema is a simple condition except when it occurs as a symptom of some graver condition, such as indigestion or hog-cholera. It may last but a few hours or, in more severe cases, a few days.

Treatment is unnecessary except in those cases that are due to the absorption of toxic substances from the bowel. Here the administration of a brisk cathartic dose of castor oil is the best method of treatment. This, with a suitable change in the food, is all that is necessary. Where itching is severe the official solution of lead subacetate, known as Goulard's extract, may be applied with benefit.

NETTLE-RASH (URTICARIA)

Nettle-rash, or urticaria, is a quite common disease of the hog characterized by the appearance of numerous small diamond-shaped elevations upon the skin. These elevations are due to the pouring out of a fluid between the layers of the skin.

Causes.—This disease is especially common in pigs. It is undoubtedly often predisposed to, if not actually caused, by the filthy conditions under which hogs are kept on many farms. Irritation of the skin by lice or stinging nettles is another common cause for the condition. An outbreak of nettle-rash not infrequently follows the use of irritating dips in too strong solution. It may follow sudden changes in food or the feeding of certain classes of leguminous plants.

As a secondary or symptomatic condition, urticaria is very often seen as a complication of disturbances of the stomach and bowels. It is probably caused by this means more frequently than from any other single factor.

Symptoms.—In some cases the outbreak of the eruption on the skin may be preceded for a day or two by a slight fever and symptoms of indigestion or constipation. As a rule, the eruption on the skin occurs without any previous symptoms. The lesions are noticed as small flat elevations of the skin and may be only few in number or very numerous. These blotches are most frequent and noticeable on the ears, sides of the neck, back of the forelegs, inside of the thighs, and along the under surface of the belly. The spots

are swollen, red in appearance, and vary in size from that of a pea to as large as a half-dollar. In some instances a number of the blotches run together to form one large area which may be several inches square. In a few hours the spots begin to fade at the center, and may extend at the margin, the edge of the spot always being red in color.

There is an intense itching accompanying these lesions, and the hog will rub and scratch itself against the fence, posts, or any other object that is handy. This irritation causes loss of appetite, some fever, restlessness, and even loss of weight, and an unthrifty appearance.

Course.—Urticaria is not a serious disease in itself, and the principal importance lies in the fact that it points to something being wrong with the digestive apparatus or the manner of feeding in most cases. The usual course of the disease in the hog is about four to six days, and the lesions gradually fade away and do not leave any mark behind. In unusually severe cases blisters may form and the skin scale off over the areas where the blotches were located.

Treatment.—In the prevention of this disease important stress must be laid upon the necessity of keeping hogs in clean feed lots, and keeping the animals clean and free from lice and other irritating parasites. Animals that are kept in dirty, filthy feed lots, and allowed to wallow in a muddy old hog-wallow, cannot be expected to keep free from skin diseases. Lice also are an important factor not only in this disease, but also in causing unthriftiness in swine. Care must be exercised in selecting preparations to remove lice that strong irritating solutions are not used which would cause more harm than the lice. A 2 per cent. dip of some of the coal-tar disinfectants, such as kresol, creolin, or similar preparations, is the most effective method for removal of these parasites. It is of no use to dip the animals, however, unless an effort is made at the same time to clean up the feed lots and keep them clean, so as to prevent reinfection of the hogs as soon as they get out of the dipping vat. In connection with the dipping of the herd, it is advisable in hot weather to keep them out of the sun for a few hours after they have been dipped.

Another important point in the prevention of this disease is

proper management in the feeding of swine to prevent development of digestive disorders, constipation, and other disturbances that may lead to urticaria.

With the development of an attack of the disease the best method of relieving the irritation is to give the animals a dip in a strong solution of baking soda, using about 1 pound of soda to 20 or 30 gallons of water. This can be put in the dipping vat if one is on the premises, or a smaller amount of the solution can be made up in buckets and applied by sprinkling or sponging over the affected animals. This is a most efficient preparation for relieving the itching and restlessness.

To clear out the stomach and bowels, and remove the most likely cause of the disease, a brisk dose of Epsom salt should be given with the food, giving about 1 large tablespoonful to the average size hog and 2 tablespoonfuls to the larger ones. The diet should be of a sloppy nature for a few days, and, with a thorough cleaning out of the digestive tract, the condition will rapidly disappear. Proper regulation should then be made of the method of feeding to prevent recurrence, and it is well to follow up the active treatment with a condition powder for a few days or even a couple of weeks.

ECZEMA (PITCH SCAB, SOOT OF YOUNG PIGS, PITCH MANGE)

These are all names which are applied to the condition known as eczema in the hog. Eczema is a true inflammation of the skin, and differs from a simple erythema, in that it is an actual inflammation instead of a simple reddening of the skin. Eczema is comparatively rare in the hog, and this is a most wonderful thing when we consider the unhygienic surroundings under which the hog is usually kept. If it were not for the fact that the pig appears to be peculiarly insusceptible to eczema, the disease would be one of the most common found among swine.

Causes.—Eczema is particularly frequent in young pigs. In fact, it is very unusual for the disease to develop in older hogs. It is on account of this fact that eczema derives its name of "soot of young pigs." Dirty, filthy conditions under which hogs are kept in many instances explains the cause of the disease. In many cases the disease is due to irritating substances contained in the water

of wallow-holes or in the soil of low-lying pastures. Chronic irritation of the skin by lice and other parasites may result in the development of an eczema. During hot weather the skin may become irritated from the effects of the rays of the sun. This is particularly likely to occur in white hogs and in hogs that have a light coat of hair. The charcoal that remains after burning a pile of corn-cobs is quite irritating, and if animals are allowed to wallow in the pools of water that form in these ash-piles after a rain severe eczema and even sloughing of the skin may follow.

Eczema is a disease that is especially likely to occur in weak, debilitated animals that are run down as the result of some other disease, such as rheumatism, rickets, chronic hog-cholera, or chronic indigestion.

Symptoms.—This disease makes its appearance in the form of an eruption of the skin, appearing especially on the inner surface of the thighs, sides of the chest, along the belly, and on the inner side of the forelegs. Occasionally it may appear also on the eyelids, muzzle, and other parts of the body. In pigs suffering with scours an eczema often appears on the hind parts where they are soiled with the irritating discharges from the bowel.

Eczema is especially noticeable in white hogs, owing to the color of the skin and the ease with which eruptions may be noted on it. The affected parts are red in color, swollen, inflamed, and quite hot and painful. Intense itching and burning is an especial feature of eczema, and the animal will rub or bite at the affected parts almost continuously. The lesions at first consist simply of reddened elevations on the skin, but a little later these are covered with small blisters, filled with a clear, sticky, honey-like fluid. This soon becomes converted into pus, and then the blisters break and crusts are formed. These crusts, by admixture with dirt, have a black, greasy appearance.

As a result of the irritation the animal is restless, appetite is irregular, and the hog takes on an unthrifty appearance. In run-down pigs the disease may prove very severe and the animals die of exhaustion. When the disease has lasted for several weeks or months large sores develop on the affected parts and the skin becomes thickened and cracked. Where the disease is allowed to

run along untreated, large sloughs may develop and the animal loses weight and strength and becomes permanently stunted.

Treatment.—Prevention of the disease consists largely in keeping the feed lots and sleeping quarters clean and dry. Old dirty hog-wallows are a constant source of irritation to the skin. Another important factor in preventing this disease is proper feeding, especially of young pigs, to prevent chronic bowel trouble and consequent weakening of the animal. Eczema will very seldom develop in an animal unless its condition is below normal.

The most essential point in the successful treatment of a case of eczema consists in determining the cause and removing same. In nearly every case some cause for constant irritation exists, and if this be overcome the condition will quickly clear up of its own accord. In many cases, if the skin be examined, large numbers of lice will be found, and these parasites are an important part of the cause of the disease. As a first step in the treatment of such cases it is desirable to have the affected animals dipped in a 2 per cent. solution of kresol or some other effective disinfectant dip.

For the purpose of relieving the itching and protecting the skin from air and irritation oily solutions should be applied. Small amounts of carbolic acid (10 gr. to the ounce) may be added to linseed oil or olive oil and applied for the purpose of relieving the intense itching. Ointments are often useful, the most effective being the official zinc oxid ointment or a paste made of zinc oxid, starch, and vaselin. Carbolic acid, in amounts of about 10 gr. to the ounce, may be added to these ointments to increase their power in relieving itching.

Attention should also be given to the bowels, and a cathartic of calomel and oil given to sweep out any irritating substances that may be present. Much benefit will also be obtained by the administration of a good condition powder containing powdered nux vomica, powdered gentian, sodium bicarbonate, and sulphate of iron. In the long-drawn-out chronic cases small doses of arsenic may be added with benefit.

RINGWORM

Pigs occasionally develop ringworm quite similar to that seen in man and other animals. It is seen most commonly on the back,

sides of the chest, over the loins, and on the outer side of the hams. The disease appears as scattered, rounded, and reddish spots about the size of a quarter dollar or larger. The margin of the spot is red and elevated, giving it a somewhat ring-like appearance. The center of the spot is apparently almost normal in color and appearance. The red elevated margin is often covered with small vesicles, and these later on break and cause the formation of a crust. In some cases the bristles or hair over the affected parts fall out. This is rare in the hog, however, as compared with the horse and other animals.

Treatment.—Perhaps the most efficient means of treating ringworm is the daily application of formalin (a 40 per cent. solution of formaldehyd in water) to the lesions. This can be applied with a feather or a small brush, and is reported to be most successful in causing disappearance of the eruption.

Where hard crusts and scabs are formed they should first be removed by means of soap and water or oils and the treatment then applied. There are a number of other preparations which may be used in the treatment of this condition. Calomel ointment or mercury ointment are both commonly used. Ointments containing salicylic acid, tar, balsam of Peru, and naphthol are favorably reported by a number of practitioners.

MANGE (HOG ITCH)

This is a condition not uncommon in hogs in which the skin is infested by large numbers of scab mites. These mites, by burrowing under the skin, produce a severe irritation, and the disease is accompanied by the formation of thick masses of scales or scabs, from which the disease derives its common name of "scabies."

Causes for the disease are filthy, dirty pens which favor the breeding of the scab mites. Run-down, poorly nourished animals are also commonly attacked by mange. In animals with chronic indigestion or chronic hog-cholera mange is a not infrequent complication. Mange is more common in pigs than in the adult animals. Mange as well as other skin diseases is more common in white hogs than in those with colored hair.

Symptoms.—The disease begins with a severe itching of the affected portions of the body. Mange lesions are more commonly

located in the neighborhood of the head, along the back, behind the ears, or over the croupe. Accompanying this itching there is seen the appearance of large amounts of a bran-like, dry scale, which piles up to form thick, crust-like masses. The skin becomes hard and thickened and lies in heavy folds along the back. In the creases between these folds there may be noted superficial raw, bleeding spots. Itching of a most severe type, together with the finding of these scales, makes the diagnosis clear. If the scales are removed and the underlying surface closely examined it will often be possible to see the small mite which causes the disease.

Treatment consists in removing the scales by a thorough scrubbing with soap and water, followed by the application of sulphur ointment. The sulphur destroys the mites and thus prevents the re-formation of scales. If the sulphur proves irritating, and causes an inflammation of the skin, this may be relieved by the application of a mild zinc oxid ointment. Very commonly in butchers this disease affects the hands and arms as a result of handling mangy hogs. In treating those affected it must be remembered that the hog mite will attack the human skin.

PEMPHIGUS

This is a skin disease characterized by the formation of a number of large blisters or vesicles over the surface of the body. These vesicles are often as large as a hazel-nut and occur without any apparent cause. They contain a clear fluid and are not accompanied by any inflammation of the surrounding skin. Pemphigus is more common in the larger animals, but is occasionally seen in the hog. The appearance of the vesicles may be preceded for a few days by signs of gastric and bowel derangement, with a slight feverish attack and loss of appetite.

In the course of a few days the wall of the sac bursts and the fluid escapes, leaving a red, inflamed base which often itches quite severely. There may be considerable constitutional debility following an attack of pemphigus.

Treatment consists in the application of a dry dusting-powder to the inflamed surface after the vesicles have ruptured. It is also a good plan to administer a tonic for several days to overcome the constitutional derangement.

WARTS

These are quite commonly seen on the skin of hogs. Warts are caused by piling up of thickened skin, and they are often seen in run-down, stunted animals. Old boars also frequently develop warts. The favorite locations for warts are the inner surface of the ear, the inside of the thighs, and the muzzle. An excellent specimen of warts, taken from the inner surface of the ear by Dr. Waugh, of Pittsburgh, Pa., is to be seen in the Pathological Museum of the Terre Haute, Ind., Veterinary College.

These growths often reach considerable size, and it is not unusual to find a wart the size of a hen's egg on the throat or ear of an affected animal.

Treatment for warts consists principally in their surgical removal by means of the knife or scissors. Following the removal of the growth the surface may be touched with a red-hot iron to destroy the base of the wart. Where the wart is small in size it may be successfuly treated by applying daily a salve containing 1 dram of salicylic acid in 1 ounce of vaselin or lard.

Warts are harmless growths, and it is just as well to leave them alone unless they become so large as to be troublesome.

DISEASES OF NERVOUS SYSTEM

CONGESTION OF BRAIN (HYPEREMIA OF BRAIN)

Causes.—This is a condition which may be produced in hogs in hot weather by overheating due to handling. Hyperemia of the brain is especially likely to occur where animals are run and chased over feed lots in an effort to catch and restrain them for purposes of injecting serum, castration, ringing, and similar purposes. The condition is unusually liable to be developed in fat animals, as these stand handling very poorly as a rule.

Symptoms.—The principal symptoms are dulness, stupidity, and an awkward gait. There is also considerable evidence of exhaustion as a rule. The animal breathes rapidly and the pulse will be found to be rapid and feeble. There may be a period of excitement in which the animal is very restless, and this will be followed by the period of depression.

Treatment in these cases consists essentially in keeping the animals quiet. Get them out of the sun into a cool place, and leave them alone, undisturbed. The condition is only a temporary one, and with rest and quiet entire recovery takes place in two or three hours.

INFLAMMATION OF BRAIN (BRAIN FEVER)

In congestion of the brain there is simply a dilatation and overfilling of the blood-vessels of the organ. In inflammation of the brain the condition is a more serious one, and there is a genuine involvement of the brain tissue. Brain fever, as the condition is commonly called, is rather uncommon in the hog, but may be seen occasionally in run-down animals or in hogs that are suffering from some of the acute infectious diseases, such as pneumonia or hog-cholera.

Brain fever may also occur in fat animals as a result of overexercise, sunstroke, or blows on the head. In animals that feed in the same yards with cattle the condition occasionally develops as

a result of a kick on the head. Tumors of the brain or the presence of parasites in the cranial cavity may result in symptoms of brain inflammation. The disease may also be seen in animals soon after shipment for considerable distances on railroad trains.

Inflammation of the brain or its coverings exists in many cases as a complication of acute infectious diseases, such as hog-cholera and pneumonia. Overfeeding, and especially feeding of large amounts of certain kinds of poisonous plants, may lead to the development of inflammation of the brain.

Symptoms.—The symptoms of brain fever differ somewhat with the nature of the cause. In some cases the disease is preceded by a period of dulness, but in the majority of cases the active symptoms come on suddenly. There may be some appearance of drowsiness and dulness, but, as a rule, the animal is excitable, irritable, and very sensitive to noises or handling.

During the period of excitement the animal may show some very interesting symptoms. It will grind the teeth, froth at the mouth. run around in a circle, butt into trees, posts, or other objects that come in its way, and may even attack other animals or the owner if he comes into the pen. In the very severe cases the delirium often becomes furious. The animal squeals, grunts, and becomes very vicious. It may even attempt to climb up the sides of the pen or over fences that come in its way. In other cases the sick animal will press its head against the wall or fence, and remain in this position until seized by a convulsion, when it will fall over and stiffen out until the seizure passes over, when it may get up and again become violent.

This period of acute excitement is usually of short duration. It may not last longer than half an hour, and is followed by a period of deep depression. The animal lies down and refuses to move. The eyes are closed, and the hog gradually passes into a state of stupor. During this stage of the disease stomach symptoms and vomiting sometimes develop.

While in simple congestion of the brain the symptoms usually pass away in the course of a few hours, true inflammation of the brain is a more serious matter and the animal rarely recovers. The stupor deepens, convulsions are repeated, and the animal finally dies.

Postmortem Diagnosis.—In cases that have died of inflammation of the brain, if the brain be examined after death some very interesting findings are seen. The covering membranes of the organ are found to be congested and inflamed. In cases that are caused by a kick or blow this reddening and thickening of the membranes is especially marked at the point where the injury was received.

Beneath the membranes, and pushing them up from the underlying brain, there is usually found a collection of straw-colored fluid. This may be rather flaky in appearance, due to the presence of infection by pus germs. When the brain itself is cut into, this same fluid is found distending the cavities of the organ. The gray matter of the brain is found to be swollen and congested. It appears red in spots and darker than normal in other locations. The entire organ is somewhat softened and infiltrated with this inflammatory fluid.

Treatment.—Preventive treatment consists in keeping pens and feed yards clean and free from disease-breeding holes and stagnant ponds. Avoid handling hogs during the heat of the day, and especially use care in handling fat, plethoric animals.

In the active treatment of the disease it is essential that the animals be at once removed to a cool, shady spot and kept as quiet as possible. It is preferable to remove them to a cool, dark boxstall, where they will have plenty of room to move about without danger of injuring themselves. Food should consist only of soft, sloppy substances and plenty of fresh, cool water.

Bleeding is often resorted to with benefit for the purpose of relieving the congestion in the head and brain. Cold water, poured over the forehead and between the ears, is often beneficial in overcoming the congestion. A large dose of Epsom salt may be given in some cases, but it is not advisable to tussle with the animal in attempting to give a drench, as this makes the condition much worse. Chloral or opium are valuable agents in overcoming the excitement and quieting the movements of the animal during the period of excitement.

After the severe symptoms have subsided, the animal should be kept in a cool dark place for several days and fed on a light diet to which some tonic condition powder may be added. In those

rare cases that are followed by paralysis of one or more groups of muscles, iodid of potash and tincture of nux vomica should be given three times a day with the food, administering about 20 gr. of the iodid of potash and 15 drops of the nux vomica.

MEGRIMS (VERTIGO, BLIND STAGGERS)

This is a condition which is seen in the hog occasionally as a primary condition. It is quite a common symptom of some of the acute diseases.

Causes.—The most common cause for true blind staggers in the hog is the presence of parasites in the brain tissue. The most common of these is the echinococcus cysts. The condition is also sometimes seen as a symptom of other disorders affecting the brain, such as anemia, congestion, and inflammation. Not uncommonly blind staggers occurs as a result of acute inflammation of the bowels or as a symptom of severe toxic diseases, such as hog-cholera.

Diseases of the heart may also cause attacks of dizziness by interfering with the circulation of the brain. Foreign bodies in the ear by scratching on the membrane of the ear may cause sufficient reflex irritation to cause staggers.

Symptoms.—The attacks of vertigo are quite characteristic in appearance. The animal becomes dizzy, is attacked by periods of blindness, and often walks around in a circle. This is especially the case in those forms of the disease due to the presence of the cysticercus parasites. The animal may jerk the head up and down or shake it from side to side. In other cases, after taking a few staggering steps forward, the animal will fall on the side and roll over and over.

The attacks may be of only short duration, and the animal may entirely recover in an hour or two. If the disease be due to parasites in the brain, they will recur at frequent intervals.

Diagnosis is made between this disease and epilepsy, which it somewhat resembles, by the absence of convulsions in staggers.

Treatment.—The treatment of this condition lies almost entirely in discovering, if possible, the cause. Those cases that are due to digestive disturbances can be relieved by cleaning out the bowel and giving a tonic condition powder for a few days. Cases that are due to the presence of cysticercus offer no hope for treat-

ment, and the best method of handling these cases is to sell the animals for slaughter.

During an acute attack of staggers the animal should be placed in a darkened pen, and kept quiet for a few hours until the attack has passed over. No medication is necessary, as a rule.

EPILEPSY (FALLING SICKNESS)

Definition.—Epilepsy is a chronic disease, in which the hog is subject to recurring attacks of convulsive seizures, during which the animal falls to the ground and all the muscles of the body are stiff and rigid. During the intervals between the attack the animal may appear to be in good health.

Causes.—The true cause of epilepsy is not thoroughly understood, but it is probably due to some abnormal irritability of the cells in the outer portion of the brain, or to some disease of the brain or spinal cord. In-breeding is believed by many authorities to be a cause for epilepsy, and there seems very reasonable grounds for the belief that the disease is hereditary in nature.

Intestinal worms and severe inflammation of the bowels or stomach may cause convulsions in young pigs, but these attacks are not a true epilepsy, and must be differentiated from the real falling sickness.

Symptoms.—Just before the attack comes on the animal appears restless. It goes about and roots up the ground in an uneasy sort of manner. Finally, the convulsive movements make their appearance, commencing, as a rule, in the muscles of the head and extremities. The muscles of the head begin to jerk, the jaws are ground together, and the hog becomes unsteady on its feet, finally reels and falls over. The head is drawn back, foaming froth escapes from the mouth, and the urine is passed involuntarily. Often the animal bites the tongue, and the saliva, as a result, is blood stained. The different muscles of the body are now seized by successive convulsive contractions, and, owing to spasm of the muscles of the chest, breathing becomes very difficult.

The true epileptic seizure lasts for several minutes, and the pig is left in an exhausted condition when the seizure is over. These attacks have a tendency to recur at regular intervals, and, as a

result, the animal becomes stunted, loses weight, and not infrequently dies in an attack.

In some cases the seizures are more mild, and last but a few seconds. Consciousness may not be entirely lost and the entire attack is mild.

Treatment.—For the purpose of relieving the immediate spasm dipping the animal in a tub of warm water is about the most simple and effective procedure. This can be very easily done in the case of young pigs. With older animals relaxation can be accomplished by dashing a pail of cold water on the head. For the purpose of preventing further attacks bromid of potash is the one effective remedy. This should be given in doses of 20 to 30 gr. with the food two or three times a day. In a true epileptic case even this agent may prove unsuccessful, and in such cases the best procedure is to get rid of the animal by selling him for slaughter. In true epilepsy the attacks grow more severe and more frequent as the subject gets older, and death is likely to occur in a few months during one of these seizures.

Crotalin, or rattlesnake venom, has been lately advocated as a treatment for epilepsy. It is a rather expensive agent, but would be justified in the case of valuable pure-bred stock.

SPASMS (ECLAMPSIA, CONVULSIONS)

This is a condition which is frequently met with in young pigs as a result of reflex irritation of the nervous system from inflammation of the stomach and intestines. The spinal cord of the pig is especially susceptible to reflex irritation, and convulsions are very easily produced by inflammations in other parts of the body. These convulsions are often mistaken for true epileptic seizures, which they very closely stimulate.

Causes.—These attacks occur with such great frequency at the time of teething that there is a disposition on the part of many authors to consider the extreme sensitiveness of the gums at this time as one of the principal causes of the disease. This undoubtedly does have something to do with the attacks, but there can usually be found some digestive or other disturbance which is in large part the actual cause of the attacks. Overloading of the stomach with indigestible food, the presence of large numbers

of worms, or acute inflammation of the stomach and bowels, are frequently at the bottom of the condition. Pigs which are poorly developed, and especially those that are attacked by rickets, are very likely to have convulsions.

Symptoms.—The symptoms of this condition are quite similar to those described under the head of Epilepsy. Here, too, there may be certain warning symptoms, such as loss of appetite and restlessness. Finally, the convulsive seizure begins in the muscles of the head and the extremities, and gradually spreads to involve the entire body. The pig falls over and becomes stiff and immovable. The seizure may last but a few minutes, or it may be prolonged for a half hour or more. Frequently one attack follows another, until the animal finally dies from exhaustion. This is especially liable to be the case where the spasms come on in the course of some acute inflammation or as a result of poisoning from some chemical irritant.

Treatment.—As convulsions in pigs are practically always secondary conditions, and due to some underlying irritation, the most essential thing in the treatment is to determine what is causing the attacks and remove this cause if possible. For the immediate relief of the spasm an effective practice is to take the little fellow and place him in a tub of warm water. If any chloroform is at hand the convulsions can be relaxed by a few whiffs of this drug. Recurrence of the attacks can be prevented by administering full doses of bromid of potash (about 10 gr. to an average-sized pig), or chloral hydrate may be given, in doses of 5 to 10 gr.

As irritation of the stomach and bowels is the most frequent cause, it is fairly good practice to give an emetic as soon as possible. For this purpose $\frac{1}{4}$ gr. of apomorphin may be injected under the skin or a cup of mustard-water may be given by drench. After the stomach has been emptied in this manner, a dose of calomel (1 to 2 gr. for small pigs) should be given, to be followed the next morning with an ounce of castor oil. In those cases that appear to be due to irritation of the teeth and gums, irrigation of the mouth with a solution of potassium chlorate, or with simple cold water to which a little vinegar has been added, will give marked relief and prevent recurrence.

PUERPERAL CONVULSIONS (PUERPERAL ECLAMPSIA)

This is a name which has been applied to convulsive seizures occurring in the sow during or immediately following the delivery of the litter. It is a not uncommon condition in other animals as well as the sow, and is of quite frequent occurrence in the human family.

Cause.—The cause of puerperal eclampsia is unknown. There have been a number of interesting theories brought forward to explain these peculiar attacks, but none of the explanations so far given can be accepted as entirely satisfactory. Some men think that the convulsions are due to excessive irritation of the nerves in the region of the uterus during prolonged labor, but this theory cannot be accepted, as the attacks often occur even after very easy deliveries.

Another and more plausible explanation is the theory that the convulsions are the result of poor action on the part of the kidneys during the last weeks of pregnancy. At this time the kidneys have a large amount of waste to work off, and, if they are in any way deficient in their action, a large amount of poisonous material collects in the blood-stream, and this, by irritation of the nervous system, produces the convulsive attacks.

Symptoms.—The animal may be noted to be getting restless and toss about somewhat uneasily. Suddenly the muscles of the jaws and of the limbs will be noted to stiffen, the eyes begin to roll, and the breathing becomes difficult. Froth often appears at the mouth, and the animal may bite her tongue, as in an attack of genuine epilepsy. These convulsions last for one or two minutes, and are followed by relaxation of the body and extreme exhaustion. The attack may recur in a few minutes, and each succeeding attack is usually more severe than the first. If the pulse be taken at this time it will be found to be very rapid and bounding in character.

Postmortem Changes.—This condition frequently causes death, and when the body is opened up but little change can usually be found. There may be some swelling and a pale appearance to the kidneys, and this often is the only change of importance that can be determined.

Treatment.—The preventive treatment of this condition consists in careful dieting of the sows during the last weeks of pregnancy

to avoid overfeeding, and especially the feeding of any substances that are irritating to the kidneys. Plenty of water should be provided, and the sows kept in pens where they have plenty of room for exercise.

At the time of the attack the best remedy for use is veratrum viride. Of a good fluidextract of this drug 15 drops should be injected beneath the skin. This will bring down the rate of the pulse, relax the spasms, and prevent their recurrence more effectively than any other agent known. For the purpose of hastening elimination of toxic materials the animal should receive a large dose of castor oil, and should be fed with a sloppy diet for several days. Where the convulsions are severe, the action of the veratrum may be aided by the administration of chloral hydrate, in teaspoonful doses, well diluted with water, and given as a drench

PARALYSIS OF POSTERIOR PART OF BODY

Causes.—Breaking down or paralysis of the hind parts of the body is a condition which is quite commonly met with in heavy hogs. There are a number of reasons advanced for this condition. Some authorities believe the paralysis to be due to lack of development of the bones, resulting in fracture of the thigh bones later on. This lack of bone development is largely due to improper feeding, especially to lack of mineral matter in the ration. Growing animals require a certain amount of mineral substances in the food, in order that the bones may obtain sufficient salts to properly develop.

Another very common cause for this breaking down of the hind limbs is inflammation of the spinal cord. When the cord becomes diseased at any point along its course paralysis of that portion of the body located posterior to the seat of the inflammation results. Inflammation of the cord is especially likely to occur in fat hogs as a result of some injury to the back, such as being stepped upon by cattle or horses. Pressure on the cord from tumors, or an excessive deposit of fat in the region of the back, causing pressure on the cord, are also possible causes for inflammation of that structure. In some cases parasites locate themselves in the cord and form cyst-like tumors, which by pressure shut off the nervous control and cause paralysis of the posterior part of the body.

Injuries received in shipping are sometimes followed by the

development of paralysis of the hind limbs. During the breeding season this condition may develop as a result of injuries produced by an overvigorous and heavy boar. After nursing a large litter of pigs, sows are frequently left in a weak, run-down condition, and posterior paralysis is not uncommonly seen in such animals. During the winter months, when hogs are allowed to overcrowd and pile up on top of each other, injuries to the back frequently occur which result in inflammation of the cord and paralysis of the hind parts of the body.

Indigestion and constipation are regarded as possible causes for the condition. Especially is constipation to be regarded as a possible cause of this paralysis, as the overloaded large bowel may, by pressure upon the spinal column, cause disturbances of nerve-supply and pressure paralysis.

A condition which very closely resembles posterior paralysis is seen in the acute infectious diseases, and especially in hog-cholera. The condition in these diseases is more due to muscular weakness, however, than to interference with the nerve-supply.

Symptoms.—The condition may appear very suddenly or, more commonly, it may come on gradually. In practically every case of true paralysis both hind legs are involved. In those cases that come on gradually the animal will first be noticed to have a peculiar, unsteady gait. The animal is noted to weave from side to side when walking, the hind legs not being able to follow in a straight line with the front feet. The hind part of the body may be carried very much to one side and sort of dragged after the front portion. In attempting to move or stand the animal gets the hind feet crossed over each other. For a time the animal is able to stand and sort of throw the hind limbs after the front ones. When the hog so affected lies down there is considerable difficulty in getting up. As the condition advances and grows worse, the weakness becomes more pronounced, and after a time it is impossible to get on the hind legs at all, and the animal simply drags the hind quarters along the ground.

At the beginning of the attack the general health is usually good. The animal eats well and there is little disturbance of health or loss of condition for several days. If recovery does not take place, however, within a week or so the animal begins to show signs

of ill effects from the disease. Loss of appetite now takes place, the bowels become constipated, and the hog loses weight and strength.

Examination of the back is often disappointing. No signs of injury or evidences of local pain are to be found in the majority of cases. When the animal is forced to get up or move about it may show signs of discomfort by squealing and resistance. Finally, as the disease becomes worse, it is impossible for the animal to rise at all.

In those cases that develop a complete paralysis, and become unable to get on the hind feet at all, the condition becomes very serious, and it is not long, as a rule, until some inflammation of the bowels or other parts of the body sets in and causes the death of the animal. In those cases that are due to injury of the back, kidney inflammation is especially liable to develop and carry away the hog.

Treatment.—As in many other diseases, an ounce of prevention here is worth a pound of cure. Growing pigs should be given a well-balanced ration, so as to prevent lack of development of the bones and predisposition to fracture of the bones of the hind limbs. In the same manner, sows that are nursing a large litter of pigs should be well fed, in order that they may not be run down and weakened to the point where they are likely to develop a paralysis of this nature. If the sow shows signs of weakening from the heavy drain upon her system she should be allowed to wean the pigs rather than entirely destroy her vitality.

Every effort should be made to avoid injury to heavy hogs, and they should be kept under such conditions as will prevent as far as possible any injuries of this kind. In shipping animals, overcrowding and rough handling is to be avoided as much as possible. Especially is it necessary to use care in corralling animals and driving them not to produce injuries of the back. Many valuable animals have been permanently disabled through injuries of this kind, such as being hit over the back with a club in the hands of an employee. The hog is proverbially hard to drive, and loss of temper on the part of those trying to drive the animal often results in serious injury.

When an animal is noticed to be lame behind it should at once be removed from the lot and placed in a pen by itself. The animal

should be kept warm and comfortable and fed on a light, sloppy diet. The bowels should be stimulated to action by a mild dose of castor oil or Epsom salt mixed with the food. If constipation is very marked, an injection of warm soap and water may be given to unload the large bowel.

Stimulating liniments may be applied over the back. An excellent application of this kind is the so-called hartshorn liniment, consisting of equal parts of ammonia-water and sweet oil or linseed oil. Another excellent liniment is made by adding ½ ounce of croton oil to 3½ ounces of oil of turpentine. Where these liniments, combined with rest and proper food, fail to bring relief, the best method of handling the case is usually to sell the animal for slaughter while in good general condition. In the case of valuable pure-bred animals it may be advisable to attempt further treatment.

In such cases counterirritation of a more severe form than that produced by the use of liniments may be tried. The use of the firing iron along the back, in a manner similar to that used in firing the legs of horses, is sometimes tried. Dr. Peters, of the Illinois State Serum Plant, recommends the following method for firing the back in a hog: Fourteen or fifteen pieces of No. 16 wire, pointed at one end, are placed in a charcoal or corn-cob fire and heated to white heat. When properly heated, they are grasped by a pair of pincers or tongs, and the pointed ends plunged through the skin and into the fatty tissues along the back. The skin should be punctured about every 1 or 2 inches along the entire region affected by the paralysis.

For the purpose of improving the tone of the nervous system various nerve tonics may be tried. The best of these is strychnin, which may be given in the form of the powdered drug or in strychnin tablets. The dose of this drug for the hog would be about $\frac{1}{60}$ to $\frac{1}{15}$ gr. twice or three times a day. The drug may be more handily given in many cases in the form of tincture of nux vomica which contains strychnin. The dose of the tincture of nux vomica for a hog is about 15 drops three times a day. This may easily be administered in the food. It acts not only as a nerve stimulant, but also improves appetite and general tone of the entire body.

SUNSTROKE (HEAT STROKE)

Hogs are particularly susceptible to the effects of the rays of the sun and to overheating. This is especially the case with fat animals. It is always dangerous to try and handle a fat hog on a hot day, as the least exertion may produce a fatal overheating. This should be remembered in the administration of hog-cholera serum, and where fat hogs are to be treated in hot weather the work should be commenced as early in the morning as possible.

When hogs are hauled to market in hot weather or shipped in overcrowded cars there is great danger of overheating and death. In like manner, hogs that are kept in feed lots or pastures that have no shade suffer extremely with the heat on a hot day. This is in part due to the large amount of fat, and also to the fact that the skin of the hog offers no protection against the direct action of the rays of the sun.

Where animals are allowed to overcrowd in a wagon, car, or shed, they may suffer from heat prostration which is due to simple overheating, and not to the effects of the rays of the sun.

Just why the rays of the sun or the overheating of the body from other causes should produce the symptoms seen in these conditions is rather hard to understand. Some authors believe that the effects are largely due to some chemical action of the rays of the sun upon the nervous system. A more plausible explanation is the theory that the heat of the sun is so marked in these cases that it causes excessive heating of the central nervous system, and in this manner produces paralysis of circulation and respiration.

Symptoms.—The symptoms of overheating and sunstroke are so nearly the same that there is little need of trying to make a distinction between the two. The animal will in some cases show no evidence of the oncoming attack until suddenly noted to wobble and fall over in a convulsion. In most cases there are a few warning signs. The animal begins to droop, the ears fall forward, the gait becomes uncertain, and, finally, the animal topples over unconscious and is seized by a convulsion. Unless relief is promptly given death very quickly takes place.

If an examination of the pulse be made, it will be found to be very rapid and weak. The temperature is very high, often rising to 110° or 112° F. in cases of sunstroke.

Treatment.—The condition is usually due to neglect or carelessness in handling animals, and can be prevented quite easily with the use of a little common sense. Great care should be used in handling hogs, and especially fat animals, during the heat of the day. If serum is to be given or the animals moved to market the injection should be made in the early morning before the sun gets high.

During hot weather the animals should be kept in a pasture that is shaded, so they may find protection from the direct rays of the sun. A cool, sanitary hog-wallow is a source of great comfort to the animals during the hot weather.

When an animal is seen in an attack prompt measures are necessary if life is to be saved. Cold water should be poured over the head, *but not on the balance of the body.* If cold water be thrown over the entire body it makes the condition worse, and will almost certainly produce death. Cold applied to the head is the most convenient and effective measure at hand. The animal is also in need of stimulation, and if any whisky is handy it should be given in tablespoonful doses every hour or two. If possible, it is better to inject the drug into the loose tissues beneath the skin back of the foreleg or along the flank. Strychnin is also a valuable agent in these cases, and $\frac{1}{4}$ gr. of the drug or 15 drops of tincture of nux vomica may be given with the whisky. Aromatic spirits of ammonia, camphorated oil, and ether are all valuable diffusible stimulants, and should be administered per mouth or injected under the skin, if at hand.

DISEASES OF ORGANS OF LOCOMOTION

RHEUMATISM

THIS is a painful condition affecting the organs of locomotion, and may be either of one or two types. Articular rheumatism is the more common form, and is associated with marked swelling of the joints. Muscular rheumatism is more rare, and consists principally in an inflammation of the structure of the muscle itself, without any swelling of the joints. In the hog the two conditions are frequently associated, and it does not appear necessary to make any differential distinction between the two forms of the disease.

Causes.—The hog is raised under such conditions as are particularly likely to produce rheumatism, but for some reason the animal seems to have considerable resistance against the disease, as rheumatism is much less common than would be expected among swine. The articular form of rheumatism is undoubtedly a germ disease and is produced by infection of the blood, and through the blood the joints, by some specific germ. Keeping animals in cold, damp pens, and exposure to wet and cold are important predisposing causes, in that they lower the resistance of the animal to and make it easy for the germs to enter. Overheating followed by exposure to chilling winter winds is especially liable to cause an attack. Overfeeding and excessive exercise may be followed by the muscular type of the disease. Dipping of hogs in cold, damp weather may set up an attack of the disease.

Symptoms.—The symptoms of acute articular rheumatism are very pronounced and quite easily made out. The animal has a high fever, loses appetite, and develops a most severe painful lameness. In the articular type this lameness is associated with large painful swellings of the hock, knee, and joints of the feet. These swellings show a tendency to change location, and one day the hock may be affected and the next day the knees and the feet. This tendency to shift about is very characteristic of rheumatism.

In the muscular type of the disease the muscles of the back are more commonly affected. This is the condition commonly known in human beings as "lumbago." The muscles of the back are swollen, tender, and the back is held arched and very stiff and rigid.

In the severe cases the animal suffers a great amount of pain, and remains lying in the litter most of the time. If forced to move about the sick hog is able to do so only in a very stiff manner and every movement is painful. Severe pain is caused by any pressure upon the affected muscles of the back or any effort to move the affected joints.

In the more mild attacks the only symptoms may be a stiffness of the gait and a tendency for the lameness to shift from one part of the body to another.

Course.—The course of an attack of rheumatism is very variable. The symptoms may pass away in a few days, or a chronic lameness may develop which will last for several weeks or months.

Complications.—Rheumatism, if it be of the severe type, is often complicated by the development of an inflammation of the pleura, or, even more commonly, by development of acute inflammation of the heart. These complications are announced by a rise in the temperature and severe prostration.

Treatment.—Much can be accomplished in the prevention of this disease by exercising care in handling of the animals with regard to proper sleeping quarters. Cold, damp, poorly ventilated sleeping sheds are very largely responsible for this condition in most cases. Allowing animals to sleep around old straw-stacks or under manure piles is almost equally as productive of attacks of rheumatism.

In the handling of an attack the first consideration is to get the animal into a warm, comfortable place where proper care can be given. The sick hog must be protected from drafts and exposure to wet and cold. This is a most essential part of the treatment, and is more important even than the administration of drugs.

As a start of the medicinal treatment, the animal should receive a brisk cathartic, such as calomel or castor oil. Following this salicylate of soda and bicarbonate of soda should be admin-

istered in large doses. The dose of the salicylate of soda should be about 30 gr. three or four times a day, and at the same time a dose of a teaspoonful of bicarbonate of soda can be given. These are both powders and can be given on the food. The diet should be liquid and sloppy. Milk diet is especially valuable and dry food should be entirely withheld for a few days.

In the muscular type of the disease macrotys is more valuable than the salicylate of soda. Fluidextract, or specific medicine of macrotys may be given in half teaspoonful doses every three or four hours. This can be added to a little slop and given in this way.

As a local application to the inflamed and swollen joints, one of the most efficient applications is ichthyol. This may be applied in a 50 per cent. solution in glycerin, or may be used in the form of an ointment containing about 2 drams of ichthyol to 1 ounce of vaselin. Another good application to these inflamed joints is belladonna liniment, or the commonly used white lotion may be applied. White lotion is made by taking 3 drams of lead subacetate and 3 drams of zinc sulphate and adding these to 1 pint of water. The preparation is a most effective one in removing pain, soreness, and inflammation from local swellings, bruises, and sprains.

After the active symptoms of the disease have subsided under the use of salicylate of soda and sodium bicarbonate, with the local applications, the animal should receive some form of tonic medication to rebuild strength and restore normal function all over the body. As a result of the acute infection the animal is usually run down, and the blood especially is likely to be in a weakened condition. As an after-tonic a preparation containing iron, gentian, nux vomica, and bicarbonate of soda should be used. This can be fed with the food once or twice a day for two or three weeks until the sick hog has entirely regained strength and energy.

SORE FEET

Common Causes.—Hogs are quite frequently subject to attacks of sore feet, which may be due to bruising of the hoof or to some form of inflammation. In cold, winter weather the feet may become sore as the result of bruising in walking over the rough, frozen

ground. In like manner, hogs after shipment for a considerable distance in stock cars may come out in the morning quite lame and sore. Another common cause for sore feet is the keeping of animals in filthy, dirty, muddy pens. In these cases the skin between the toes becomes softened and irritated, and germs from the filthy lots enter the skin and set up a quite severe condition.

Symptoms.—The principal symptoms of the condition, of course, is the lameness. When the feet are examined they will be found to be bruised and swollen in case the lameness is due to injury, or they may be found softened, inflamed, and scaly in the case of infection. In many of these cases due to filthy feed yards the condition present is really an eczema.

Treatment is largely to be governed by the cause. If the condition be due to recent shipment in railroad cars, nothing need be done in the way of treatment. Simply turn the animals out into a pasture range or into a clean feed lot and the lameness will disappear in a few days. In those cases that are due to filthy feed lots a change of range, giving a clean, dry pasture, is all that will be required.

In the more severe cases, where there is genuine eczema or infection present, the treatment will need to be a bit more active. Bathing of the feet in some strong astringent solution, such as equal parts of vinegar and water or in strong salt solution, may prove efficient. An excellent foot-bath for these cases is made by dissolving a teaspoonful of chlorid or sulphate of zinc in a pint of water. In cases where the feet are red, swollen, and tender this should be followed by the application of zinc oxid ointment. This is an excellent healing application, and its use will be followed by good results.

FOOT-AND-MOUTH DISEASE

In animals that suffer from sore feet the possibility of foot-and-mouth disease must not be overlooked. This disease at present is unknown in the United States, but there have been several outbreaks in the past, and stock owners should always be on the lookout for the disease.

In an outbreak of foot-and-mouth disease cattle are usually first affected, and the disease may then spread to the swine. The characteristic symptom of this disease is the finding of large num-

bers of vesicles or blisters between the toes and along the lower part of the foot. There may also be some blisters in the mouth and on the tongue. The presence of a similar condition in the cattle on the premises is a valuable aid to diagnosis.

Foot-and-mouth disease is a very dangerous and rapidly contagious disease, and at the first signs of an outbreak State and United States Government authorities should be notified, in order that prompt steps may be taken to stamp out the infection before it gets a foothold.

RICKETS (RACHITIS)

This is a disease in which there is a marked disturbance of nutrition, and the animal is unable to properly develop bone tissue. As a result, there is a lack of hardening of the bones, and marked swellings and deformities take place.

Rickets is especially common in pigs. It is also seen with considerable frequency in young dogs. The disease is much more rare in calves and foals.

Causes.—This disease is one which is practically entirely due to improper feeding. It occurs especially at about the age of weaning and shortly thereafter. During the time when the pig is living on the milk of the mother there is seldom any difficulty, unless the diet of the sow be especially poor in those foods which aid in the formation of bone tissue. In the breeds that develop very rapidly after weaning this disease is especially frequent.

The milk of sows is especially well supplied with the salts of phosphorus and calcium. These salts are very important in the development of bone in growing pigs. The pig must necessarily have these large amounts of phosphorus and calcium in order to do well. It is for this reason that they are liable to develop rickets when weaned from the mother and placed on a diet that is poor in these substances.

When we have added to this improper diet a filthy, muddy feed lot we have just the condition necessary for the development of rickets. Growing animals cannot do well even with proper food when placed in a filthy feed yard, and, when we have a combination of the two, the little animals are bound to suffer. In the great hog-producing belt of the Central West there is a tendency to feed large amounts of corn, often to the exclusion of other articles of food.

Corn is an excellent food for hogs when properly fed, but it does not form a well-balanced diet when fed without any other grain.

When for some reason the mother of the litter dies or fails to nurse the pigs, and it is necessary to bring them up on cows' milk or some other form of food, rickets may develop. The milk of the cow, while suitable for the growth of calves, is not of the proper quality for feeding rapidly growing young pigs. As a result, the bone development in pigs fed in this manner is delayed and typical rachitis may occur.

Disease of the stomach and intestines of a chronic type is another frequent cause of rachitis. As a result of the inflammation of the bowels and stomach, food is not properly digested and absorbed, and while the animal may be taking into the body the necessary amount of food and of the proper quality, it does not get the usual benefit from it, on account of being unable to properly digest and use it in building of bone and other tissues in the body.

In like manner, presence of worms in the stomach and intestines may sufficiently interfere with digestion and assimilation of foods to result in lack of development and growth. These parasites are perhaps a more frequent cause of digestive disturbances than is generally recognized.

Changes Produced.—As a result of the lack of calcium or bone-forming salts the bones fail to harden as they should. The constant movements and the weight of the animal produce irritation of the soft bone-forming tissues, and, as a result, a sort of inflammation is produced. This results in an increased production of cartilages, especially around the ends of the long bones. When this process has been continued for some time it will be found that the ends of the bones are enlarged and the long bones may show considerable deformity from bending under the weight of the body. The swelling of the ends of the bones gives a swollen appearance to the joints, and this is one of the first symptoms noticed by the owner. As a result of the weakness of the bones it is not unusual for them to break under the weight of the animal. This is especially likely to occur in the case of the long bones of the hind limbs, producing symptoms quite similar to those described under Paralysis of the Posterior Part of the Body.

Symptoms.—If the animals are closely observed it will be found

in most cases that preceding the actual development of symptoms of rickets there are certain disturbances of digestion. This often takes the form of loss of appetite, the animals become weak, and bloating of the belly may be a prominent symptom. As the disease progresses the animal frequently develops an abnormal appetite, showing a desire for dirt, gnawing on the sides of the pen, and drinking manure water. This is simply an effort on the part of the pig to secure those elements of food in which its diet is lacking.

Some time before the deformity in the bones is noticeable the animals suffer from severe pain and aching of the muscles, bones, and joints. The pigs will walk with a stiff, lame gait, and lie down a great deal. They will often rise only when forced to do so, and then will squeal and grunt when made to move about. In some cases the pain is so severe that the animals are unable to rise or use the limbs at all. In some cases the affected pigs will be found to assume a kneeling position much of the time.

After a few days or weeks of these digestive and motor disturbances the signs of deformity begin to make themselves prominent. These changes are at first noticeable only in the long bones. The ends of the bones become very much enlarged, and give an appearance quite similar to the swelling of the joints in articular rheumatism. By feeling of the swollen limbs the difference may be very easily detected. In rickets the enlarged ends of the bone can be plainly felt. In rheumatism there is no swelling of the bones, simply a filling of the joint itself with fluid.

Later on in the course of the disease there is noted swelling along the ribs and bending inward of the ribs along the sides of the chest. The swellings on the ribs are often arranged in the form of two rows of button-like elevations a short distance on either side of the breast bone. These rows of small swellings are often referred to as the rachitic rosary, from their resemblance to a string of beads.

With the continued softening of the long bones of the extremities the weight of the animal forces them to bend, and deformities of various kinds are the result. In the hind legs, where most of the weight of the body comes, there may be actual breaking of the bones. The legs frequently become frightfully bowed, and the animal, as a result, is clumsy and awkward in trying to walk.

As the disease progresses there is loss of weight, and the bones of the skull frequently begin to enlarge, giving the pig a very peculiar appearance, with a large head and small, thin body. Where the disease progresses for any length of time the pig always loses weight and becomes a chronic, worthless runt.

Changes in the teeth are often noticeable. There may be irregular shape of the teeth. The second teeth are often slow in coming in, are often short and irregular, and soon loosen up and fall out. The gums and lining membrane of the mouth may be inflamed and the animal is scarcely able to eat any food except slop.

In most cases of rickets there is a certain amount of disturbance of the respiratory apparatus. The animal often has a chronic discharge from the nose and sniffs and wheezes while attempting to breathe. After lying down for a short time the nose and throat become clogged up, and when the animal gets up it has to cough and sniff in order to clear the passages.

Treatment.—This disease is one which can be entirely prevented by proper attention to diet. When pigs are weaned especial care must be taken to see that they receive a ration which is properly balanced. Dry corn alone is not a proper diet for young growing pigs. They must have other food along with the corn if they are to grow and develop properly. A small amount of salt and charcoal are valuable articles of diet to promote proper development and growth of young pigs.

Next to proper diet the most important point in the prevention of rickets is properly cared for feed lots and ranges. Growing pigs should have a clean, dry feed lot, with plenty of room to exercise, plenty of sunshine, and a clean, dry, warm place to sleep. When kept under these condition and fed a properly balanced ration there will be no trouble in keeping them free from rickets.

When the disease is noted in the herd the attention should at once be directed to the diet. If an improper ration has been fed, make such changes as are necessary to make it a proper nourishing diet. Get the animals into proper feed lots, and give them a good range, with plenty of nutritious food and room to exercise. If there is any digestive trouble, clean out the bowels with a dose of calomel and castor oil, and follow this with the administration of a tonic condition powder, containing powdered nux vomica, powdered

gentian, sulphate of iron, and a small amount of arsenic. Bone-meal is also a valuable addition to the diet in these cases and may be easily procured. Calcium carbonate in powdered form, added to milk, and fed in this manner, is often followed by good results. About a teaspoonful should be added for each animal in the herd.

If the disease is taken early and proper change made in diet, tonics administered, and the animals placed in clean, dry feed yards, no trouble will be experienced in getting a complete recovery. In cases that are neglected until severe deformities have occurred but little can be done, and these chronic runts are best knocked in the head.

BULLNOSE (OSTEOMALACIA, SNUFFLES)

Definition.—This is a condition which is very closely related to rickets, and by some authors is classed as merely a more advanced or special form of that disease. In bullnose the most marked changes are produced in the bones of the head, and considerable deformity takes place in the shape and size of the cheek bones and the bones of the snout. The disease is practically always accompanied by an inflammation of the lining membrane of the nostrils, and this is probably the starting-point of the disease.

There is another disease to which the term "snuffles" is more properly applied. This has already been described under the head of Malignant Rhinitis, and is due to a specific germ, known as the Bacillus pyocyaneus. In this condition there is a severe form of inflammation of the membrane lining the nose, but no deformity of the bones of the head.

Causes.—As in the case of rickets, the cause of this disease is to be found largely in improper feeding. Lack of calcium and other bone-building mineral salts in the food seems to be an important element in the disease. The animal, weakened by improper nutrition, becomes susceptible to germ infection, and this starts in as an infection of the membrane of the nose. The changes produced by the local inflammation weaken the tissues and predispose to abnormal changes in the bones of the head. Dirty, poorly drained feed lots and improper sleeping quarters are also of importance in rendering the animal more liable to disease.

Symptoms.—This disease usually starts in with a severe infec-

tion of the nose. The breathing becomes noisy and difficult, and accompanied by a disagreeable, irritating discharge from one or both nostrils. The disease at this time very closely resembles an ordinary cold in the head. The discharge, however, keeps up, and the animal begins to show signs of unthriftiness. There is loss of appetite or the animal may develop a desire for unusual articles of food, as described under the head of Rickets. The discharge from the nose collects in the nostrils and throat, and when the animal gets up it is forced to cough and sniff repeatedly in order to clear the nose so it can breathe freely.

The condition is not rare even in old hogs. I saw a case a few weeks ago in eastern Illinois in a brood sow weighing perhaps 300 pounds. The owner first noticed the condition as a discharge from the nose, which he mistook for a simple inflammation of the nostrils. A week or two later he noted the swelling of the bones of the head, and thought that perhaps the animal had been kicked or trampled on by one of the horses or cattle ranging in the same pasture. This case finally developed into a typical example of snuffles.

The difficulty in breathing gives rise to a continuous sniffing or sniffing sound from which the disease derives its name of snuffles. Bleeding from the nose sometimes occurs in the more advanced cases [illegible] of the lining of the nose.

[illegible] discharge becomes a [illegible] of the [illegible] with a well-marked [illegible] marked de- [illegible] derives [illegible] may also un- [illegible] The [illegible]

[illegible] The hair [illegible] downward [illegible] sow above [illegible] less than [illegible] The inflammation of the nasal mu- [illegible] and there is [illegible] of a sore [illegible]

Course.—In some cases the course of the disease is quite rapid, and the animal may die from weakness and exhaustion within a few weeks after the onset of the attack. In other cases the course of the disease is long drawn out, and the animal may drag along for several weeks or months. The condition, however, is practically always progressively worse and little or no improvement is ever seen.

Treatment.—The only treatment of any benefit in this condition is preventive. Proper food, proper quarters, plenty of room for exercise, plenty of sunlight, and plenty of clear fresh water for drinking purposes are the main factors in preventing the occurrence of this disease. With the onset of the disease a change of quarters, proper change of diet, and the feeding of such substances as bone-meal are indicated. This, with the administering of a bitter tonic condition powder, may check the disease.

After deformities of the bone have developed there is little or nothing that can be done. Potassium iodid in large doses (20 to 30 gr. three times a day with the food) may prove of value in a few cases. The best method of handling this disease, however, if it does not show improvement in a short time, is to recommend slaughter of the animal while the disease is still a local one, and while the meat may be used for food purposes.

PARASITIC DISEASES

HOG-LOUSE (HÆMATOPINUS SUIS)

In the large hog herds of the corn belt a very frequently found parasite is the hog-louse. This parasite is known in scientific literature as the Hæmatopinus suis. It is called *hematopinus* because it is a blood-sucking parasite, and *suis* because it is found on the hog. So we find that this parasite is, in reality, the blood-sucking parasite of the hog or the blood-sucking louse.

Fig. 89.—Hæmatopinus suis: *a*, Head with piercing stylet; *b*, antennæ, five segments; *c*, deep notch in which the eyes are implanted; *d*, claws on end of terminal segment; *e*, abdomen; *f*, thorax, bearing three pairs of legs (Kaupp).

The Hæmatopinus suis is the largest of all the animal lice. It is about $\frac{1}{5}$ inch long and about $\frac{1}{10}$ inch wide. When examined under a magnifying lens or a reading glass, the parasite will be found to have a head, a thorax or chest, and a posterior body or abdomen. If we look closely at the head of the parasite we will find many interesting things about it. At the extreme end of the head there is located a piercing stylet or sucking apparatus,

by means of which the louse is able to pierce the skin of the hog and suck blood. On each side of this piercing stylet will be noted five small hairs.

A little further back along the head of the louse will be seen two small arm-like feelers—the antennæ. These feelers will be found to be composed of small segments, each antenna having five segments. Just behind the antennæ there are two deep notches, one on either side of the head. Deep in the bottom of these notches are located the eyes of the parasite.

When we examine the chest or thorax of the Hæmatopinus suis it is found to have attached on either side three legs, giving the parasite six legs in all. These legs are jointed and divided into segments, and at the end of the last segment the louse is provided with a pair of claws, one large and one small. Between these claws there is a thin disk-like membrane, and on this membrane a number of small hooklets, which give the parasite exceedingly strong power of attaching itself to the skin of the hog.

The posterior portion of the body or abdomen of the louse is wider than the chest and carries no legs. The male parasite can be distinguished from the female by the appearance of the abdomen. In the male parasite there is a dark streak to be seen on the middle and under surface of the last three segments of the abdomen. The male parasite is also considerably smaller than the female.

In general appearance the Hæmatopinus suis is a grayish-colored parasite. The edges of the head, thorax, and abdomen are dark in color. On the animal body these lice are very easy to find, as the thin hair of the hog gives them but little protection, and they are readily seen.

These parasites multiply by means of eggs. The female louse lays a large number of eggs which are known as "nits." In a herd infested with lice these nits are easily found. The egg, which is quite small, yet large enough to be readily seen with the unaided eye, is cemented on the hair by means of a gelatinous substance poured out of the mouth of the mother parasite. The egg is of a yellowish or yellowish-white color, oval in shape, and tapers somewhat to a point at the end, which is attached to the hair. The free end is somewhat larger, and is covered by a lid-like cap, which is lifted off by the young louse when hatched. Through the

opening thus made the newly hatched parasite comes out and attaches itself to the hair of the animal, or may drop to the ground and wait for a favorable opportunity to attach itself to a host.

It is not difficult, as a rule, to find lice on hogs if they are present. The size of the parasite and the thin hair possessed by the hog make it a rather easy matter to locate them. There are some parts of the body where they are particularly common, and where they can be found very easily. The favorite place is in the grooves or folds of the skin back of the ears. Here the louse and the nits are especially common. The inner side of the hind legs is also a common location for the louse. The reason that lice choose these locations for attachment is that the skin here is thin, and it is easy for the parasites to pierce through and obtain the blood upon which they live.

Lousiness is a very widely distributed affection among hogs in the United States. In recent serum injection work I have found about 80 per cent. of the herds treated to be lousy. In serum injections it is very easy to notice lice if present, for the favorite seats of injection of serum are also the favorite locations for attachment of the hematopinus.

There are a number of causes which may explain the presence of lice in a herd. Animals that are kept in poorly ventilated, tumble-down, dirty sheds and pens are almost certain to become the hosts of large numbers of these lice. Unclean, badly drained feed lots and old dirty mud-hole wallows are favorable factors in the breeding of the hog-louse. Unthrifty animals, such as those which suffer from chronic digestive disturbances and a chronic cough, are particularly likely to become victims of the blood-sucking louse. They are in a naturally weakened condition and offer but little resistance to attack by the parasites. Healthy, clean animals are not often found to be favorable hosts by the louse, and, even though they may become affected, the parasites do not seem to find conditions suitable for their existence, and they drop off and look for a more desirable victim.

Bringing in of new hogs from an affected herd and adding them to the home feed lots without first inspecting them for lice and dipping them, if any are present, is a common means of scattering the

louse among the entire drove. The lice quickly become brushed off by rubbing of the hogs against each other, and by rubbing of the lousy animals against fences, posts, shed walls, etc., and from the ground they very quickly find their way to the body of a second animal, where they attach themselves and begin the deposit of nits in large numbers.

Dirty, filthy sheds and sleeping quarters give the lice extra comfort and increase their breeding facilities. These sheds, pens, and feed lots become infested with lice, and it then becomes a difficult task to get rid of them, as even though the parasites on the body of the hogs be destroyed by dipping or other means, the animals soon become re-infested from the sheds and pens. It takes a considerable amount of work and persistent effort to rid a premises of lice once they get a good start and establish breeding places.

Symptoms.—The symptoms of lousiness in some cases may be very few. The affected animal will scratch or rub against posts, fences, wagon-wheels, and any other objects which are convenient in order to relieve themselves of the irritation produced by the bites of the parasites. As a result of the constant biting, the animals become very restless and do not eat or sleep well. In young pigs the symptoms of unthriftiness may become quite marked. The skin of pigs being quite thin, it is easy for the louse to feast upon them, and when pigs are present in a herd they immediately become favorites with the lice and are liberally attacked.

As a result of the bites of the lice and the constant rubbing, together with the filthy conditions under which the infested herds are usually kept, various forms of skin disease may develop. Urticaria and eczema are especially common in hogs that are affected with Hæmatopinus suis. The parasites, by their bites, make openings through the skin, and into these openings irritating germs are carried by dirt that works into them. The result is soon an inflammation of the skin that adds greatly to the animal's discomfort. This causes more rubbing, more restlessness, loss of appetite, and causes young hogs to become unthrifty, stunted, and very runty in appearance.

In older animals the general health is not so much affected

by the presence of lice upon the skin. Large numbers of the parasites do, however, cause considerable irritation, and the skin becomes irritated, covered with scales, and frequently is covered with an eczema.

There is another great danger in the presence of the hog-louse that may be overlooked. This is the ability of the louse to carry other diseases from animal to animal. Sucking blood as it does, and pushing its sucker or stylet deep into the tissues, there can be but little question that the hog-louse is capable of carrying cholera germs from one animal to the other. Not only can the parasite carry the germs of the disease, but also through the drain that they make upon the system and the irritation they produce they make the animal more susceptible to the effects of the cholera poisons and more likely to die from an attack of the disease.

Diagnosis.—There is no trouble in making a diagnosis of lousiness in a herd of swine. The animals exhibit quite familiar symptoms in the rubbing and scratching of the body, and the louse as well as the nits can be easily found by examining the portions of the skin where they are particularly common. Especially should an examination be made of the skin back of the ears and on the inner side of the hams. In both of these locations the lice and their eggs, cemented to the hair, will be found.

Treatment.—In considering the treatment of lousiness in the hog we must take into consideration several things. In the first place, we must use some substance that is capable of destroying the living lice on the skin of the animal. Second, the nits must be destroyed. Killing the lice is a fairly easy matter, but destruction of these nits is by no means so readily done. The eggs are surrounded by a tough, gelatinous coat, which gives them an added protection and makes it a difficult matter to destroy these eggs. If they are left on the animal they hatch in a few days or weeks, and the body is soon covered again with lice.

Another important point to be considered in ridding the herd of lice is the condition of the quarters in which the animals are housed. If these are serving as breeding places for the lice, little can be accomplished unless proper steps are taken to rid these breeding places of the parasites or a change of quarters made. For instance, where the hogs are allowed to burrow around an old

straw-stack, and this straw has become filled with lice, little good can be accomplished by dipping the hogs and allowing them to go back under the straw and become re-infested from the lice hidden there. These old stacks must be burned or the hogs turned into another feed lot where they will not come in contact with the parasites.

In ridding a herd of lice we have then to consider: (1) The destruction of the living lice on the animals at the time of treatment; (2) the destruction of the eggs or nits; (3) the cleaning up of the quarters so as to prevent re-infestation.

Fig. 90.—During seasonable weather a weekly dip in a concrete tank containing 12 barrels of disinfecting solution keeps every pig clean, free from vermin, comfortable, and in perfect health—a great improvement over the usual disease-breeding "wallow hole" too common with hog breeders. Tank at "The Cedars," Columbus, Ohio.

Use of Dips.—For the purpose of destroying the lice on the body of the animal there are a number of dips which are quite effective. In former years arsenic, tobacco, and sulphur were quite commonly used as agents. In the past few years there have been a number of coal-tar preparations introduced which are very effective, reasonable in price, and convenient to handle. Creolin, lysol, kresol, and liquor cresolis compound are good examples of this class of disinfectants. They are sold under a large number of different names, each firm having its own name for the special product that it turns out. They all depend for their therapeutic value

upon the amount of coal-tar derivatives they contain. Each manufacturer has special arguments to offer why his particular product is a little better than any one's else, but any of these dips, put up by a reliable chemical house, will be found to be effective.

For dipping purposes, where a large herd is to be handled, it is advisable to have a dipping tank or vat into which the hogs can be driven and forced to wallow through the dipping solution. There should be enough of the solution in the tank to entirely cover the body of the animal, and the tank should be long enough so that it will take the animal several seconds to get through it. In this manner the disinfectant is quickly brought in contact with every part of the skin and the lice are all reached.

The strength of the solution should be about 2 per cent., that is, to each 25 gallons of water $\frac{1}{2}$ gallon of the kresol or other dip should be added. If the tank holds 50 gallons of water, add 1 gallon of the disinfectant; if 100 gallons of water, 2 gallons of the compound, and so on.

These coal-tar disinfectants will destroy the live parasites, but they will not destroy all of the eggs or nits. In order to accomplish their destruction it is necessary to dip the animals once or twice a week for two or three weeks, in order that the newly hatched lice be destroyed before they have had time to become mature and lay more eggs. In this manner we can finally rid the animals entirely of the lice, provided they are not running in infested feed lots and sleeping in infested quarters, where they become re-infected with the full-grown lice.

These coal-tar dips have an added benefit in the treatment of this condition, in that they also relieve the itching and irritation of the skin produced by the bites of the lice and by the secondary urticaria and eczema. The effectiveness of the dipping process is increased if the animals are kept in a fairly close pen for a few hours after dipping, as in this way they rub against each other and brush off large numbers of the lice and nits as well as more evenly distributing the dip.

Kerosene Emulsion.—Many hog raisers and stockmen have for several years treated hog-lice by use of a kerosene emulsion. This is a milk-like preparation made by combination of ordinary coal

oil with soap and water. The formula for making a strong solution of this form of dip is as follows:

Kerosene	2 gallons.
Soap	8 ounces.
Water	1 gallon.

Dissolve the soap in boiling water. Add this solution while hot to the kerosene, stirring the mixture vigorously for ten minutes.

This forms the strong or stock solution. When it is desired to use this for dipping or spraying of animals, 1 gallon of the strong solution is added to 9 gallons of water and used in this strength.

The kerosene emulsion has some advantages over the coal-tar preparations, in that it is probably more destructive to the nits and almost equally as efficient in destroying the live lice. It is not as valuable, however, in relieving the irritation of the skin, and, unless care is used in its application, it may even be the cause of quite severe inflammation of the skin that is more dangerous than the lice for whose destruction it was intended.

Kerosene emulsion is not advisable to use in the early part of the day. If the animals are dipped in this preparation in the morning, and allowed to run in the sun during the day, the rays of the sun, acting upon the kerosene-soaked skin, produce a very severe inflammation, and in young pigs with a thin, sensitive skin may produce quite dangerous consequences. Kerosene dips are best given late in the afternoon or evening, and the kerosene has thus a chance to dry off before the sun strikes the pigs on the following day. It is even better to keep them in a shaded lot for a couple of days after dipping.

Spraying.—Where a dipping vat is not at hand, and the number of animals is not large enough to justify putting one in, the dip or coal-oil emulsion may be used by means of a spray pump or an ordinary sprinkling can. The animals should be thoroughly sprinkled or sprayed, and especially should those parts where the lice are most commonly found be thoroughly soaked with the disinfectant solution.

While this method is not as effective as the use of these same solutions by means of a dipping vat, yet very good results can be obtained where a little care is taken. This method requires more of the solution, as there is considerable waste which is avoided by use

of the dipping vat, and where any large number of hogs are to be dipped the vat will pay for its cost in the amount of disinfectant that will be saved, to say nothing of the convenience and time saving that it allows, as well as more thorough work and satisfactory results.

Disinfection of Quarters.—As has already been pointed out, no progress can be made if the dipped animals are turned back around an infected straw-pile or hog shed. These old straw-stacks should be burned or hauled away for manure, or fenced off so that the hogs cannot get to them. Old tumble-down sheds must be thoroughly cleaned up, repaired, and liberally sprayed with the disinfectant solution, using about a 5 per cent. strength for this purpose instead of the weaker solution used on the hogs.

Where it can be conveniently done, it is the best plan to turn the hogs after dipping into a new range and keep them away from the old feed lots for several weeks. The hog-louse cannot live long without getting upon the body of a hog, and will die out if the hogs are kept away. In the meantime the lots can be thoroughly cleaned up, tumble-down sheds removed or repaired, old straw piles disposed of, and thorough disinfection accomplished by a liberal spraying of the ground and sheds with a strong solution of the disinfectant.

Rubbing Posts.—The rubbing post is also a common means of combating the louse in hogs. This post can be home-constructed very readily. All that is required is to take a round post about 8 or 10 inches in diameter, and bore down through the center of it a hole 2 or 3 inches in diameter. Now take a small bit and bore holes through the side of the post so that they will open into the central bore. These small holes should then be plugged with a soft, porous wood, which will permit oil to soak through them.

After being thus prepared the post is now set in the ground in the middle of the feed lot, and kerosene oil poured into the hollow space in the center of the post. This oil will seep out through the small wooden plugs and give the entire post a continuous coating of oil. The lousy hog will rub against the post as a natural attempt to relieve its itchiness, and the oil coming in contact with the parasites destroys them most effectively.

While a valuable aid in ridding the herd of lice, these rubbing posts cannot take the place of the dipping vat, and should be used as an aid to, and not as a substitute for, the dip method.

In order to overcome the harmful effects of the restlessness and irritation produced by the parasites it is an excellent idea to add a small amount of a tonic condition powder to the feed for several days. The gentian, nux vomica, iron, and soda combination already mentioned is an excellent appetizer and tonic and will cause a marked improvement in a few days.

No herd should be allowed to remain lousy. It is considerable effort to rid the animals of lice once they get a good start, but the work will be many times repaid by the benefit it does. Animals cannot gain properly in weight while constantly irritated by a large horde of lice over their bodies. Especially is this the case with young pigs, and many of these little fellows are permanently stunted as a result of long-continued torment from these blood-sucking parasites. The fact that these lice are also probably capable of transmitting hog-cholera from one animal to another is also worthy of consideration and a powerful argument in favor of getting rid of them.

SCAB MITE

Scab or scabies is not a very frequent disease in the hog in the United States. It is produced by the itch mite of the hog, known under the official name of Sarcoptes scabiei suis. This, literally translated, means the sarcoptic scab mite of the hog. The mite is very small, and is provided with a head, body, and four pairs of legs. The parasite burrows under the skin and produces a large amount of scales, which pile up on each other and give a very characteristic appearance. The symptoms and treatment of this condition will be found in the section on Diseases of the Skin.

Sarcoptic mange is the only form of the disease which is seen in hogs. In the sheep and the horse there are also found a psoroptic and a symbiotic mange. Neither of these types are found in the hog, and the sarcoptic mange is relatively uncommon in the United States, although quite frequently met with in Europe.

It is worthy of note that this itch mite of the hog frequently attacks man, and butchers, farmers, packing-house employees, and others that come in contact with hogs frequently develop a severe

form of itch as a result of infestation with this scab mite. The treatment for the condition in man is not much different from that in swine. Thorough washing of the hands and arms with a strong soap-suds, followed by application of a sulphur ointment, will destroy the mites. The sulphur application may cause some inflammation of the skin, but this can be rapidly relieved by applying cold cream or other soothing ointment.

ROUND-WORM (ASCARIS SUILLA)

The common round-worm which is found in the intestines of the hog is known in scientific works as the Ascaris suilla. This is one of the most common parasites of the intestines of the hog, and is found widely distributed among the herds in the United States as well as in Europe. In the large packing-houses at Chicago, Kansas City, and Omaha these parasites are found in large numbers in nearly half of the animals that are slaughtered at these points.

Description.—The Ascaris suilla is a round worm, pinkish or yellowish-white in color. The body is round, firm and elastic, and tapers at each end. The head end of the parasite tapers more markedly than does the tail. The female worm is larger than the male, and will average about 11 inches in length when fully matured. The male parasite when completely developed averages about 7 to 10 inches in length. The male worm is further differentiated from the female by the fact that it has a curved tail, while the female has a straight hind extremity.

The parasite when examined under the lens will be found to have a small head located at the anterior extremity, which is recognized by the fact that it is the most pointed. If this head be closely examined it will be found to possess a mouth which is provided with three lips.

These worms have a complete, fully developed digestive apparatus, and can take up food from the contents of the intestines and digest it. They are not blood-suckers and do not draw blood from the mucous membrane.

The manner of reproduction and infection of these parasites is very simple. The female parasite becomes filled with eggs, and these are laid in the bowel, where they become mixed with the intestinal contents and are carried out with the feces. These eggs

or ova are very small, being only about $\frac{1}{700}$ inch in length, and can be seen only under a powerful lens or with the aid of a microscope.

When the eggs reach the ground they become mixed with earth and water, and these contaminated substances, especially the water, are taken into the stomach of the growing animals. The stomach juices set the young parasite free from the shell of the egg, and the newly hatched worm passes into the bowel, where it rapidly develops into a full-grown parasite. Young pigs and growing shoats are especially susceptible to these round-worms, and may show very marked symptoms as a result of infestation by them.

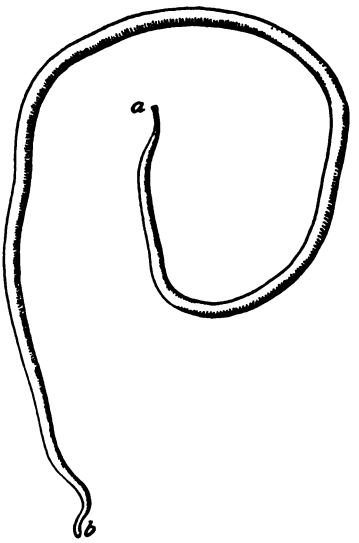

Fig. 91.—Ascaris suis (a young one): *a*, Head extremity; *b*, tail extremity. (From Kaupp's Animal Parasites.)

Predisposing influences in the production of round-worm infestation are those which tend to allow drinking of contaminated water and eating of dirty food soiled with mud or earth containing these eggs. Eating off of dirty feeding floors and drinking of water from shallow ponds and dirty watering troughs are especially prominent factors in encouraging the development of this disease among young animals. If the pig be unthrifty from any cause, such as digestive trouble, chronic cough, or any other exhausting disease, the chances for development of round-worm infestation are the more marked. Strong, healthy pigs may be able to throw off the parasites without developing any signs of being wormy.

Symptoms.—Round-worms do not produce any typical chain of symptoms that would enable one to make an absolute diagnosis of the condition present unless they were to find the worms in the discharges from the bowels. There are, however, a certain group of symptoms found in worm-infested animals that may lead to a quite convincing suspicion that worms are present.

If the number of parasites in the bowel be small there may be little or no disturbance resulting from their presence. A slight diarrhea, perhaps a little restlessness, and an occasional disturbance of appetite, that is hardly noticeable enough to attract attention. When large numbers of the worms develop they produce a more positive chain of signs. With hundreds of these parasites in the bowel, food is unable to pass along as it should, and the pig is frequently attacked by colicky pains, scouring, and becomes very restless. In addition to this, the appetite becomes irregular, food is not properly digested and absorbed, and the animal soon becomes unthrifty and begins to lose in weight and strength. If they be closely watched the pigs will often be seen to pass worms.

Treatment.—In the treatment of worms in the hog the best manner of administering drugs to destroy the parasites is to select some remedy which can be given with the food, and allow the animal to take it in this way. The dosing of hogs with a tablet or liquid drench is quite unsatisfactory, as a rule, in the treatment of worms, and much better results will be obtained with far less effort by the method of carrying the drugs into the bowel through the slop.

For the treatment of the round-worm two of the most effective agents are areca nut and santonin. Areca nut should be given in a dose of about ½ to 1 gr. per pound weight of the animal. The santonin is given in smaller dosage, the average being from 1 to 4 gr. for each hog, according to size. These two agents can be thoroughly mixed with milk or thin slop and fed in a clean trough. The best plan is to have the drug put up in powders, each of which contains enough of the remedy to supply 10 shoats, and mix this with a bucket of milk or slop, pour it in the trough, and let 10 hogs into the lot at a time. In this manner every animal gets about the same amount of the drugs. If the entire herd is slopped at once, the more active and aggressive animals will get a large dose of the remedies, and the weaker animals, which really need it most, will get little or none at all.

Calomel is another very active agent in the treatment of intestinal worms, and may replace the areca nut in the above treatment. Where calomel is used, it should be given in dose of about 5 gr. for each 100 pounds' weight. Calomel and santonin are both in-

soluble in milk, and where these drugs are given it is a good idea to mix them with some form of ground feed or cooked mash, and fed in this manner. The same plan as above outlined should be followed to prevent the larger and more active animals getting an overdose to the detriment of the unthrifty ones. It is these unthrifty animals that probably have the most worms, and care must be taken to see that they get the proper dose of the drugs.

WHIP-WORM (TRICHOCEPHALUS CRENATUS)

This parasite is much less common in the United States than the common round-worm which has just been described. It is a much smaller worm, and, instead of being found in the small bowel, as in the case of the round-worm, this parasite is found in the beginning of the large bowel, where it is to be seen firmly attached to the lining membrane.

Description.—This parasite is only about 1½ to 2 inches long, and at its small end is only a little larger than an ordinary hair. The worm has a very peculiar appearance, due to the fact that the posterior part of the body is much larger than the anterior part, and this gives to the parasite an appearance rather similar to that of the old-fashioned black snake cattle whip. In the male parasite the thin portion of the body is coiled up like a whip, while in the female this part of the worm is straight or but slightly curved. The female parasite is also slightly larger than the male, but this is not marked enough to be plainly noticeable. Both the male and female are of a white or pinkish-white color. This worm differs from the round-worm, in that it attaches itself firmly to the lining membrane of the bowel and derives its nourishment from sucking of blood.

Source of Infestation.—The source of infestation with this parasite is quite similar to that seen in the case of the Ascaris suilla. The ova or eggs pass out of the body with the feces, and are scattered about the pastures, entering shallow pools of water and contaminating articles of food that come in contact with the egg-bearing manure. This egg-contaminated water and food again reach the digestive tract of the hog by being taken in through the mouth. In the stomach of the hog these eggs rapidly hatch, and the mature parasite develops in about four weeks. Through some peculiar

power of selection the young parasite passes the entire length of the small intestine, and does not stop and implant itself until it reaches the commencement of the large intestine. Here it apparently finds conditions suitable for its further growth and development, and it attaches itself to the mucous membrane and becomes a permanent inhabitant of this part of the bowel.

Symptoms.—These parasites are relatively uncommon in the United States, but are occasionally met with in the packing houses and while making field postmortems. Even when present, the whip-worms are usually in small number, and do not produce any marked symptoms. In rare instances there may be enormous numbers of the parasites in the bowel, and they then cause noticeable disturbance. Loss of appetite, diarrhea, colicky pains, and general unthriftiness, with loss of weight and aggressiveness, are the usual symptoms.

Treatment for these parasites is very much the same as that for the simple round-worm. Prevention consists in keeping the animals on dry feed lots and feding on clean floors, so as to prevent entrance of the ova or eggs into the stomach. Where the number of worms in the bowel becomes large enough to produce serious symptoms the hogs should be given a course of calomel and santonin, or santonin and areca nut, following much the same directions as in the case of the treatment for Ascaris suilla.

THORN-HEADED WORM (ECHINORHYNCHUS GIGAS)

This parasite is a very common one in the United States. It is a worm which is found only in the hog, no other species of animal harboring the parasite. The thorn-headed worm is so-called on account of the fact that the biting apparatus of the head is armed on either side with five or six spine-like thorns, by which the worm is enabled to attach itself firmly to the lining membrane of the bowel. It is often found in the small intestine of the hog, less frequently also in the large bowel. The echinorhynchus is often found in association with the common round-worm, but can be easily distinguished from this parasite. While the round-worms are often found in large numbers, it is unusual to find more than a half-dozen of the thorn-headed worms in a single animal.

Description.—The Echinorhynchus gigas is, as the name im-

plies, a large worm. The female often reaches a length of 8 to 12 inches; the male, 3 to 4 inches. The fully developed worm is about as large around as a good-sized lead-pencil at its anterior extremity, and tapers somewhat posteriorly. At the posterior end the female parasite is only about as large as an ordinary knitting needle. The male parasite does not taper as markedly as the female. This worm is of a milky white color, and shows on the surface of the body a number of transverse ridges.

At the anterior extremity of the worm there is a very abrupt tapering off to form the head. This head is armed with a powerful biting stylet or proboscis, by means of which the worms attach themselves. On each side of this proboscis is a bristling row of small hooklets which under a large reading glass very closely resemble the claws of a cat. This parasite has no digestive apparatus as in the case of the round-worm, but absorbs its food from the digested contents of the intestine of its host.

Fig. 92.—Echinorhynchus gigas, female: *a*, Globe-shaped proboscis, armed with six rows of hooklets; *b*, tail extremity. (From Kaupp's Animal Parasites.)

Mode of Infestation.—The manner of infestation of hogs with this parasite forms a somewhat different story from that seen in the case of the common round-worm and the whip-worm. The male and female worm breed in the intestines of the hog, and the female develops a large number of eggs, which are laid in the bowel and pass out with the bowel contents. These ova or eggs are microscopic in size, being about $\frac{1}{200}$ inch long, and can be seen only with a powerful magnifying lens or a microscope.

These eggs pass out to the ground, and are there eaten by the common white grubworm, which is the larval form of the May beetle or May bug. In the digestive tract of the grubworm the eggs hatch in a very few days and liberate the young, imperfectly developed parasite, which is the forerunner of the giant thorn-headed parasite afterward to be found in the bowel of the hog.

These little worms work their way out of the digestive apparatus of the grubworm and bury themselves in small cysts in the abdominal cavity of the worm. In rooting about the feed yards the hog unearths these worms and eats them very readily. When the worm reaches the stomach of the hog and is digested, the larval thorn-headed parasite is set free, and now commences its development in the intestines of the pig. It does this quite rapidly, and in a few weeks is fully mature and ready to commence over again its life cycle.

Symptoms.—If the parasites be present in small numbers, say one or two, no symptoms of importance may be produced. Where several of them are found they undoubtedly result in considerable harm. The worm buries itself in the wall of the bowel, and often produces severe irritation, and may even cause an abscess to form. On the outer surface of the bowel there may be a slight nodular bulging over the point of attachment of the parasite, and an inexperienced man might mistake these for lesions of tuberculosis. The mistake can easily be corrected by cutting into one of the nodules, where the head of the worm will be found buried.

The thorn-headed worm does not remain attached to the one spot, and very frequently lets go its hold on one spot to later attach itself by a fresh bite in some other part of the bowel. In this manner it very frequently causes a severe scattered inflammation of the inner lining of the intestines, which may be so marked as to be almost regarded as a true inflammation of the bowels.

As a result of this irritation and the drain upon the system of the affected animal well-marked constitutional symptoms are seen. The pig becomes thin, loses appetite, often has irregular periods of constipation, alternating with diarrhea. As a result of the continued disturbance of digestion, the affected animal develops quite severe nervous symptoms. These disturbances of the nervous apparatus are much more marked with animals that suffer from the echinorhynchus parasite than with any other form of intestinal worm. These nervous symptoms are manifested by marked restlessness, irritability, twitching of the muscles of the head and neck, and often the development of convulsive seizures resembling those of epilepsy and eclampsia. When the nervous

system becomes affected the condition is a serious one and death very frequently occurs.

Treatment.—As it is necessary for the hog to eat the grubworm in order to become affected by this parasite, the disease will be more commonly seen in pigs that are allowed to run in old hog lots, around manure piles, or in clover pastures. It is in these locations that the grubworm is particularly common. In preventing this disease a great deal can be done by feeding the animals on a board floor, and by keeping them away from old manure piles and other places where the grubworm is particularly common.

In attempting to remove this parasite from the bowels by means of drugs considerable difficulty may be met with. It will be remembered that the parasite keeps the head deeply buried in the wall of the bowel, and this makes it often quite difficult to reach the worm with the medicinal agents intended to destroy it. The echinorhynchus does not seem to be killed by calomel, santonin, or areca nut. These agents may, however, be administered in the same dosage and in the same manner as for treatment of the round-worm and whip-worm. Round-worms are often present with the thorn-headed parasite, and the drugs given will at least drive out the Ascaris suis and may bring the echinorhynchus with them.

Stockmen and veterinarians have alike found turpentine one of the most efficient remedies for removing the thorn-headed worm. This agent, on account of its penetrating qualities, seems to more effectively reach the parasites deeply buried in the wall of the intestine and forces them to let go their hold. A good purgative should be administered with the oil of turpentine, in order that the worms may be quickly swept out from the bowel while they are temporarily paralyzed by the action of the turpentine. A practical method of administering the remedy is to give from a teaspoonful to a tablespoonful of the turpentine to each animal in the morning, thoroughly mixed up with milk or thin slop. Turpentine mixes very readily with milk, and the animals will take it in this way without any trouble. It is a good plan to let the hogs to be treated go without any feed the night before and administer the drug on an empty stomach. This dose should be repeated each morning for three mornings, and on the third morning give with the turpentine a liberal dose of some active cathartic to sweep

out the bowels and carry out the parasites. For this purpose castor oil is an excellent agent, and may be stirred up with the milk along with the turpentine. By giving the treatment on an empty stomach the bowels are free from a large mass of undigested food, and the turpentine has a good chance to get at and destroy the parasites.

THE PIN-WORM (ŒSOPHAGOSTOMA DENTATUM)

In the hog of the United States the pin-worm is a fairly common parasite. In scientific text-books this worm is described under the name of Œsophagostoma dentatum, that being its correct official or scientific name. To the farmer and stockman it is much better known under the name of pin-worm. This parasite is a very small worm, and is found mostly in the large bowel. A few may be found in the small intestine, but the greater number occur in the cecum and colon of the large intestine.

Description.—The pin-worm is a very small parasite. The male is only about $\frac{1}{3}$ to $\frac{1}{2}$ inch long and the female $\frac{1}{2}$ to $\frac{3}{4}$ inch. The body is very small in caliber and white or grayish-white in color. The worm is pointed at both ends, and this is especially marked in the female parasite.

Symptoms.—If only a few of the parasites are present no well-marked symptoms are produced. The location of the worms in the large bowel and their small size makes it possible for even considerable numbers to be present without the production of any severe symptoms. When large numbers are present they produce diarrhea, loss of appetite, improper nourishment, poor quality of the blood, and an unthrifty appearance. In severe cases, if left untreated, the parasite may produce death. This is especially likely to happen if, in addition to pin-worms, the round-worm or thorn-headed worm be also present. A positive diagnosis of pin-worms is made by finding of the worms or the eggs of the parasite in the feces. Often in an animal that has died, when the carcass is opened up and the large bowel cut into, the contents will be found to be fairly wriggling with pin-worms, which are present by the thousands.

Mode of Infestation.—The mode of infestation with the pin-worm is just about the same as in the case of the round-worm. The eggs of the female are carried out with the feces and are mixed with

water and food, and afterward again find their way into the digestive apparatus of the animals with the food and drink. The eggs quickly hatch in the stomach and small intestine, and the worm attaches itself to the mucous membrane of the large intestine and takes up residence there.

Treatment.—Pin-worms seldom produce sufficiently severe symptoms to demand treatment in hogs, except when they are present in association with round-worms or the thorn-headed worm. In any case the administration of the usual worm-destroying remedies will produce results. Calomel, areca, and santonin, administered in the manner directed under the treatment of the round-worm, will usually accomplish their removal.

LIVER-FLUKES

These are occasionally met with on the meat inspection floors of this country in hogs, but this parasite is much more common in cattle and sheep, where it often produces quite severe symptoms. In the hog the liver-fluke is of little importance in this country. Clinical evidences of its presence are not marked, and it is not worth while taking time or space to elaborate on its description.

KIDNEY WORM (STEPHANURUS DENTATUM)

This is a parasite which is much more commonly known to the meat inspector in the large packing-houses than to the farmer and stockman, although it is met with frequently enough in home-butchered hogs to be somewhat familiar even to the farmer and local butcher. The kidney worm is much more common in the hogs that come from the southern part of the United States than in those raised in the corn belt and Northeastern States.

This worm is not found in the intestines, as in the case of the parasites that have just been described, but is located in the leaf-lard fat surrounding the kidney and sometimes it buries in the kidney itself. On account of this familiar location the worm derives its name of kidney worm, or lard worm, by both of which terms it is commonly designated. The worm burrows large cysts and canals in the fat around the kidney, and in these cysts, when cut into, there are found a male and female parasite, and frequently also a number of eggs. Sometimes these cysts become filled with a

considerable amount of pus-like material, and as a result the lard fat is ruined. It is not so common for the worm to invade the kidney, although it has been my experience on the killing floors of our large packing-houses that the kidney worm invades the kidney with much greater frequency than is commonly stated by most authorities.

Description.—The Stephanurus dentatum has a rounded body, which is slightly larger than a knitting needle and tapers at both ends. The outer skin or covering of the worm is colorless and transparent. The dark-colored intestinal tract shows through this outer covering, and gives the worm a rather peculiar, well-marked mottled appearance. The parasites are divided into the male and female sex. The male parasite is about 1 to 1¼ inches long; the female, 1¼ to 1½ inches.

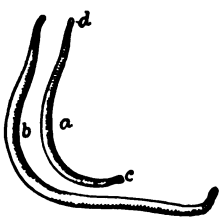

Fig. 93.—Stephanurus dentatum (kidney worm): *a*, Male; *b*, female; *c*, caudal extremity; *d*, cephalic extremity. (From Kaupp's Animal Parasites.)

Mode of Infestation.—This has never been definitely worked out, but from the location of the parasite it would seem very likely that the eggs which are laid in the region of the kidney and in the pelvis of that organ pass down the small tubes leading from the kidney to the bladder, and thence pass out with the urine to the outer world. Here they become mingled with the food and water of the animals, and are taken into the stomach and digestive apparatus. The parasite here hatches out and the small worm which emerges from the egg seems to have the power in some manner of working its way out of the intestine and into the fat in the region of the kidneys, where it permanently locates. It here burrows and encysts itself, and continues its further development, with laying of eggs and often formation of abscesses.

Symptoms.—Kidney worm is often present without producing any noticeable symptoms. Its presence is rarely diagnosed in the living animal. On postmortem examination in the packing-houses it is very commonly found by United States Bureau of Animal Industry officials in hogs that apparently are in perfect condition during life. There are many stockmen who think that the pres-

ence of this worm is responsible for a large number of cases of paralysis of the hind limbs and other diseases of the back. In past years this worm was at one time given credit for being the cause of hog-cholera. The large number of cases in which we have cholera without this worm being present is ample proof that it has little or nothing to do with the cause of the disease. In like manner, numerous cases of paralysis of the hind parts which have been examined postmortem fail to show any relation between this condition and the kidney worm.

In some few cases where the parasites invade the kidney in large numbers they may produce considerable irritation of these organs and set up an acute nephritis. Large abscesses may be formed in exceptional cases in the region of the kidneys, and these may produce considerable trouble and quite noticeable symptoms.

Treatment for this form of parasite is rarely called for, as it is unusual for the worm to produce any noticeable symptoms of disease. Even in those cases that do show symptoms suggestive of the presence of lard worms, it is practically impossible to reach the parasite by any means of medication. Turpentine is about the only drug that would seem to be of any value. This agent is eliminated largely through the kidneys, and it may be possible by its use to destroy any of the worms that are in the kidney.

Preventive treatment of this parasite is about the same as in the case of the intestinal worms. Cleanliness of feed lots and exercise of hygienic rules in matter of feeding, to avoid contamination of the food and water with feces and urine from infested hogs, is the main essential in prevention.

LUNG WORMS (STRONGYLUS PARADOXUS)

Lung worms are very common parasites of the hog in the United States, and are deserving of much more importance and attention than is usually attached to them. In meat inspection work this parasite is one of the most commonly found of all the parasites of the hog. It locates itself in the bronchial tubes and in the lungs, where it lodges in the finer bronchial capillaries. Its presence during life may often be unnoticed, but in small pigs, when the strongylus occurs in large numbers, they are bound to

produce quite severe symptoms and often cause such unthriftiness as to permanently stunt the animal.

Description.—Strongylus paradoxus, or the lung worm, is a thread-like parasite, white or brownish-white in color. The length of the worm is from $\frac{3}{4}$ inch to $1\frac{1}{2}$ inches. The male parasite is smaller than the female. On its anterior end the worm has a small mouth, and surrounding this mouth, when examined with a powerful lens, six small papillæ can be made out.

Mode of Infestation.—The mode of infestation with these parasites has never been clearly worked out, but it would seem most likely that the female worm lays a large number of eggs in the bronchi, and these are carried out with the abundant mucous secretion that is produced as a result of the irritation caused by the parasite. This egg-bearing mucus may be discharged through the nose or it may be swallowed and pass out through the intestines with the feces. In either case the result is the same. The eggs in this manner reach the ground, where they are hatched and the minute larval form of the worm is set free. These larvæ again enter the respiratory tract of healthy animals by being taken in with the inspired air through the nostrils. As soon as they reach the bronchi and trachea they find conditions suitable for their growth and development, and they rapidly increase in size until they are fully developed.

Symptoms.—The symptoms produced by lung worms will vary with the number of parasites present. If only a few of them are in the air-passages they may not cause any trouble which would be especially worthy of notice. In old animals the mucous membrane of the bronchial tubes is much less irritable than in the case of young pigs, and, as a result, we find that symptoms of this form of parasitic infestation are much more commonly met with in pigs than in older animals.

Even in pigs the symptoms are often quite mild. The main symptom noticed is a frequent spasmodic cough. The condition is properly classed as a verminous bronchitis—that is, a bronchitis produced as a result of irritation by worms, and all the prominent disturbances noted are those of a bronchitis. The coughing spells which characterize this disease are most frequently brought on when the animal gets up and starts to move around after lying

down. This cough may last for several minutes and cause considerable exhaustion and difficulty of breathing.

Symptoms of lung worms in the pig are, however, never as severe as those produced by similar parasites in calves and lambs, where the condition is often a most severe one. It is but seldom that the pigs infested by this parasite show loss of appetite, loss of weight, or unthriftiness. An occasional severe case will be met with where the general effects of the parasite are well pronounced, but, as a rule, if the animals are properly housed and fed they soon outgrow the disease, and, except for an occasional fit of coughing, are not noticeably inconvenienced.

Treatment.—Preventive treatment of these parasites is much more important than curative. The lung worm is so widely distributed that it is necessary to use every possible precautionary measure in order to prevent infection. Feed yards should be drained to keep them free from mud-holes. Old shallow ponds should be filled in and the mud-hole hog wallow eliminated. It is through wallowing in these old mud-holes and ponds that the parasite is widely spread. The larvæ present in these wallows are taken up in the mud on the animal's hide, and when it afterward dries and becomes scattered around the sheds and sleeping quarters in the form of dust the parasites are taken in with the dust-laden air and infect the lungs.

Medicinal treatment of this condition is rarely necessary in the hog. In the calf and lamb the disease is much more extensive and severe, and medical aid is often called for. By way of treatment in swine, inhalation of tar or turpentine fumes is often beneficial, but the difficulty of applying this form of treatment on a large scale makes it rather unpractical. As further aid to ridding the hog of the parasites, plenty of good nutritious food, clean feed lots, and proper sleeping quarters will be found to be all that are necessary in the majority of cases. If they are otherwise in good condition and receive plenty of proper food, pigs will outgrow the disease.

TRICHINOSIS (TRICHINA SPIRALIS)

Trichinosis is the name applied to that condition of the hog, and also of man, in which there is an infestation of the muscular tissues of the body with a worm-like parasite known as the Trichina

spiralis. This is a quite common parasite in the hog in the United States and also in Europe, and is of especial importance, in that the parasites are transmissible to man by eating of the trichina-infested pork. In man the parasite produces a very severe inflammation of the muscles and not infrequently produces death. In the United States trichinosis in man is relatively uncommon on account of the fact that we cook pork very thoroughly, and the heat used in cooking the meat destroys the parasite. In European countries, especially in Germany, Austria, and Russia, it is the custom to eat pork in a raw or only partially cooked state, and, as a result, the living parasite enters the body of man, and it is not long in producing severe results.

Fig. 94.—Fresh muscle trichinæ (Mosler and Peiper).

Description.—The full-grown worm is very minute in size and only about $\frac{1}{12}$ inch in length. The larval form of the trichina is only about $\frac{1}{25}$ inch in length. The parasite is divided into a male and female sex. Eggs are generated in the body of the female and hatch within her body. The newly hatched larval parasite then passes out into the tissues. This larva penetrates through the intestines of the animal and works its way into the muscles, where it buries itself and becomes surrounded by a lemon-shaped cyst, which is to be made out on the cut surface of the muscle as a small white speck scarcely visible to the unaided eye.

Mode of Infestation.—The most common mode of infestation in the hog is by eating of rats. The rat becomes infested by eating the meat of hogs and the offal around the slaughter houses and around the farm at butchering time or during an outbreak of hog-cholera. Hogs may also become infested through eating of dead hog carcasses or offal from slaughter houses.

When the body of the rat or the meat of an animal that is infested with trichina is eaten by the hog, the cyst surrounding the little larval parasites is digested from around them and they are set

free in the bowel. They rapidly develop into male and female parasites. These become sexually mature, and the female soon becomes impregnated with eggs, which hatch in her body and are set free in the intestinal canal of the hog. They at once burrow through the wall of the bowel and enter the blood- and lymph-vessels, by which they are carried to all parts of the body and locate in the muscles. The muscles of the jaws are especially favorite locations for the parasite. In these muscles they become lodged, and by a deposit of fibrous tissue a cyst is formed around them.

Symptoms.—The symptoms of this condition are divided into two stages. First are the symptoms produced during the stage of invasion or while the trichinæ are still in the intestines. During this period they produce irritation of the bowel and may cause diarrhea, loss of appetite, and loss of condition. After the young parasites are hatched out and migrate from the intestine into the muscular tissues the bowel symptoms clear up, and the irritation produced in the muscles often gives a close resemblance to muscular rheumatism.

Symptoms in Man.—In man the symptoms following eating of trichina-infested meat are much the same as in the hog. For the first few days there are digestive disturbances. The man may complain of diarrhea, loss of appetite, colicky pains in the region of the stomach and bowels, and there may be some feverishness. A few days later, when the young brood has been turned loose into the intestines, and has wandered off into the muscle-tissue, the symptoms resemble those of rheumatism. There is muscular pain, fever, restlessness, inability to perform the usual amount of work, and the condition often becomes severe and may prove even fatal.

Treatment.—There is no treatment that is of any value after the parasites become encysted in the muscles of the body. Prevention is the big word in the handling of the trichina infection. Offal at country slaughter houses and on the farms should be tanked or destroyed by burning, and not be left exposed for rats to feed upon. Dead hog carcasses or offal after butchering should not be thrown into the hog lots for the hogs to eat. If these two precautions are carefully followed, there will be a marked decrease in the amount of trichina infection in hogs.

During the time that the parasites are in the intestine, and while

the symptoms are those of diarrhea, loss of appetite, and colicky pain, considerable good may be accomplished by the administration of calomel and oil, followed by such intestinal antiseptics as salol or the sulphocarbolates. By this means the parasites are swept out of the bowel before they have a chance to produce their young, and the involvement of the muscles is avoided.

Prevention of the disease in man consists almost entirely in proper curing and cooking of pork. There is no danger from pork that is properly cured and well cooked, as is usually done in the American home. Thorough cooking is the only safeguard in the prevention of trichinosis in man, and every farmer should appreciate the importance of this fact, as pork forms a large part of the meat supply of the farm homes.

TÆNIA SOLIUM

This is a parasite which is of great importance in the hog from the standpoint of the possible effects upon man. The parasite does not in itself produce any severe symptoms in the hog, but when the meat of an animal infested with the cysts of the tænia is eaten by a human being the result is the development of a tapeworm in the body of this individual, with resultant symptoms of tapeworm infestation.

In the meat industry this parasite is known as the pork measle, and pork so affected is known as "measly pork." In the hog the parasite does not exist in the adult or tapeworm form, but is found only in the larval or cystic form. The parasite develops into its mature form only when taken into the body of some other animal, as the dog or man, and then becomes transformed into the long, flat, segmented parasite known as the tapeworm.

In its adult form as seen in man the parasite often reaches an extreme length, and some specimens have measured as high as 40 feet in length. The head is very small and is provided with four suckers, and armed with a double row of hooklets or arms, by means of which it gains a firm attachment to the lining of the bowels. The body of the parasite is flat and ribbon-like in appearance, and composed of a large number of small pieces or segments, which are attached more or less firmly to each other.

At the head end of the worm these segments are very small,

but as you go backward the segments become larger and more mature. These fully developed segments are filled with ova or

Fig. 95.—Eggs of Tænia solium.

Fig. 96.—Tænia solium (Mosler and Peiper).

Fig. 97.—Mature segments of Tænia solium.

Fig. 98.—Head of Tænia solium (Mosler and Peiper).

eggs, and finally break off and pass out with the feces. They then find their way into the water of wells and running streams, and

from this water to the stomach and intestines of the hog. Here they hatch out into a small embryo which is provided with six little hooklets. With the aid of these hooks the parasite penetrates the wall of the stomach and bowel and wanders off into the muscular tissues, where it becomes lodged. Acting as a foreign body, it produces a mild degree of irritation, and finally becomes surrounded by a thin wall of connective tissue within which is a small quantity of fluid, the entire mass being classed as a cyst.

These cysts are not much larger than a small grain of wheat, and often as small as the head of a pin. They may later on be the seat of deposit for calcium salts, and become hard and shiny. In these old cysts the parasite is usually found to be dead. The parasite in this cystic form is known scientifically as the *Cysticercus cellulosæ*, and is found in the muscular structures of the body, especially in the muscles of the head, the loins, the heart, the diaphragm, and the tongue. The eating of meat containing these cysts will produce tapeworm in man, as the wall of the cyst is digested in the human stomach and the little embryo escapes, after which it rapidly develops into a mature parasite, which is known as the Tænia solium, or armed tapeworm.

As the parasite produces no symptoms in the living hog, it is of interest principally from a meat inspection standpoint, and from its importance in producing tapeworm in man. No treatment for the condition is required or possible, except preventive measures to limit, in so far as possible, the contamination of water with the bowel discharges of human beings that may be affected with the tapeworm. This is of importance not only in the prevention of infestation with this parasite, but also in preventing many other more severe epidemic diseases of both man and animal.

DISEASES OF ORGANS OF GENERATION

By the organs of generation are meant those organs of the body which are involved in the reproduction of the species. Among the more important of these are the uterus, ovaries, vagina, and vulva in the sow, and the scrotum, testicles, penis, and sheath in the male animal. Diseases of these organs may be of an organic nature, in which there is actual change in the structure of the organs, or it may be merely functional, in which the interference is with the normal work which these parts of the body are supposed to perform.

STERILITY (BARRENNESS)

Definition.—This is a condition in which the sow for some reason is unable to become pregnant. The fault may be with the sow or with the male animal, but, in either case, the result is the same, conception failing to occur after breeding. The condition may be only a temporary one, due to some transient condition, or it may be a permanent affair, and render the animal worthless for breeding purposes. Barrenness is much more common in mares and cows than in sows.

Causes.—The causes of sterility are best considered under the following heads:

Causes in the Male.—Among those causes which may affect the male animal, lack of or too frequent sexual intercourse are the most important. If the male animal is not used reasonably often for breeding, he becomes more or less unable to perform his function, and may entirely lose the power of impregnating the female. On the other hand, if the boar is allowed to serve too large a number of sows the sexual organs become exhausted, and the animal is unable to perform proper service.

Old age is another important factor in determining impotency in the male hog. As the animal gets old there is a tendency for fat to collect in large amounts, and this may surround the testicle

and even form in the testicle in such amounts as to cause inability to perform normal function. This is hastened by the feeding of an unsuitable diet which will have a tendency to make the animal fat. These old fat boars become so lazy that they will refuse to cover a sow, and they seem to lose all desire for sexual intercourse.

Since the introduction of the serum method of treatment for hog-cholera we have another frequent cause for sterility in boars, due to an inflammation of the testicles and scrotum following injection of serum in the muscles of the hind leg. Care should be used in this connection, as the inflammation which follows the injection may rapidly travel upward and involve the scrotum, causing the animals to be worthless for breeding purposes afterward.

Other causes for loss of sexual ability on the part of the boar are injuries and lack of development of the penis or of the testicles. Injury, such as a blow on the scrotum, may result in starting up an inflammation which leaves the animal incapable for breeding purposes. In like manner the penis may become injured, broken, bitten, or the seat of an inflammation, which destroys its value as an organ of copulation. Sometimes a male animal will be seen in which the penis or testicles have never properly developed. These animals are, of course, worthless for breeding purposes and should be castrated and fattened for market.

Causes in the Female.—In the sow the causes for barrenness are even more numerous than in the case of the male animal. In some cases the condition is due to the fact that the sow is overfat. This cause is especially met with in pure-bred animals that have been pushed to the limit in order to get them in condition for exhibition at fairs and other shows. This overfattening results in fatty degeneration of the ovaries, and these organs become incapable of producing a healthy ovum, and, as a result, it is impossible for the sow to become pregnant.

In other cases there is an entire lack of development of the ovary, and no ova, or only immature ones, are formed. In still other cases tumors and cystic formations affect the ovary and destroy its function. These cases in which the ovary is at fault are the most serious ones and often remain permanent. The tubes which lead from the ovary to the uterus may become inflamed or plugged up with fat, and the ovum is then unable to reach the

uterus. These cases are most often met with in old fat sows or as a secondary result following inflammation of the womb.

Inflammation of the womb is another most fruitful cause of sterility. As a result of the catarrhal inflammation the womb becomes coated on its inner surface with an acid mucous discharge, which destroy the ova and semen before there is any chance for conception to take place. In some cases there is an irritability of the lining of the womb, and this organ immediately throws out the semen and ova when they are brought together within its cavity. In this way the male and female elements of conception are expelled before conception can take place.

Sows which are in poor condition may be so run down as to be incapable of producing a healthy ovum, or may even be so unsuited for breeding purposes as to possess no sexual desire, and are, accordingly, never in heat. These sows will not be served by the boar and, accordingly, cannot become pregnant. The condition, however, is only a temporary one in these cases, and is easily overcome by a course of proper feeding and tonic medication.

It is not unusual to meet with a case in which the opening into the womb is closed, either temporarily by spasm of the muscles of the vagina during the act of copulation, or it may be permanently as a result of contractions following an inflammation of the vagina or womb. In some sows the uterus has never properly developed, and is only a small rudimentary organ, entirely incapable of receiving the semen of the male.

Poor feeding and lack of exercise may be another cause for sterility in some cases. Old animals frequently breed poorly or not at all. An attack of cholera may leave the sow barren, and she may never be able to become pregnant again after an attack of this disease.

In those cases where any infection of the womb takes place after farrowing the organ may remain in a swollen, boggy condition, and it may be several months before it returns to normal condition so as to be in shape to allow of the sow becoming pregnant.

Diagnosis.—It is quite easy to determine whether it be the male or the female that is at fault. If the boar is barren, all the sows that he serves will fail to become pregnant. If, on the other hand, the other sows in the herd become piggy and the suspected

cold weather may produce abortion. In like manner, sows that are allowed to burrow around straw-stacks and manure piles may abort as a result of overheating. Overheating may also occur as a result of excessive exercise, as by being chased about the feed lot by boys, by strange hogs, by dogs, or by sows that are in heat. Sows that are in heat are especially liable to cause abortion in pregnant sows through chasing them, riding them, and also by causing a great amount of nervous sexual excitement.

Abortion may occur as a result of straining, as from chronic constipation, or by a slip on the ice. Falls received as a result of slipping on the ice account in great measure for the large number of cases of abortion during the winter season.

Rough handling is another very common cause for the sow aborting. This may occur in ringing, loading in wagons, or while handling the animals for the purpose of injecting with hog-cholera serum. When using serum in pregnant sows they should be handled by means of a rope slipped into the mouth, and the serum injected in the loose tissue back of the ears.

In connection with the use of serum and its relation to abortion it might be well to again consider the danger of producing abortion from use of hog-cholera serum. In the experience of the author no case of abortion has been seen following the use of the serum that could be directly charged to this cause. Cases will occur now and then from careless handling, but there is very little doubt that the serum itself is harmless as far as producing abortion is concerned.

Ergot and some other poisonous fungi and molds are capable of producing abortion. Especially is this the case with ergot, and where animals are allowed to pasture upon rye stubble fields abortion from eating of ergot-bearing straw may occur. Food poisoning, as from brine, washing powders, and similar substances, may result in irritation of the womb and thus cause abortion.

Abortion is also a common occurrence in the course of the various acute infectious diseases. Especially is this true with hog-cholera, and practically every pregnant sow that takes the disease will slip her pigs unless she herself dies of the disease, and even then she will frequently abort a few days before death takes place.

Infectious Abortion.—This form of abortion results from the infection of the genital passages by some specific germ, the true

Impotency in the male, especially in an old boar, may be due to disease of the prostate gland. In all cases of impotency in male animals, and especially those that are due to disease of the prostate gland, fluidextract of saw palmetto is the remedy par excellence. Obtain about 8 ounces of a high-grade fluidextract of this drug, and feed in teaspoonful doses with the slop three times a day. Keep the boar away from the sows for several weeks while giving this treatment, feed carefully with nutritious food, and allow plenty of exercise in a clean, dry pasture, with plenty of sunlight. Marked improvement and even complete recovery can often be secured by this method of treatment. This drug is an especially valuable remedy in those cases where there is lack of sexual desire, either in the male or female animal. It is apparently a valuable sexual tonic and restorative, and produces excellent results in both man and animal. There is a proprietary form of fluidextract of saw palmetto, known under the name of Sanmetto, which, while a little more expensive, is in many cases more effective than the plain saw palmetto.

ABORTION

Varieties.—By the term "abortion" is meant the expulsion of the pigs from the womb of the sow before they are far enough developed to be capable of life. This condition occurs with considerable frequency in sows, but not nearly so common as in cows or in mares. There is one form of abortion that occurs as a result of infection of the womb and genital passages with some special germ. This form is rare in swine, but when present may attack every sow in the herd. The second form occurs in single cases from a variety of causes, and is much the more common form in the hog.

Causes.—Abortion may be due to a large number of causes. The most common is some form of injury. The pregnant sow may be injured in a number of ways, such as by a kick, or being trampled upon by other animals in the feed lot. Crawling through a small door in the sleeping pens, crawling under a fence, or through a gate may cause sufficient injury of the pregnant uterus to result in the sow slipping her litter. Where the herd is kept in crowded quarters they may pile on top of each other, and in this manner cause injuries that will result in abortion.

Exposure to cold chilling winds or sleeping in an open lot during

cold weather may produce abortion. In like manner, sows that are allowed to burrow around straw-stacks and manure piles may abort as a result of overheating. Overheating may also occur as a result of excessive exercise, as by being chased about the feed lot by boys, by strange hogs, by dogs, or by sows that are in heat. Sows that are in heat are especially liable to cause abortion in pregnant sows through chasing them, riding them, and also by causing a great amount of nervous sexual excitement.

Abortion may occur as a result of straining, as from chronic constipation, or by a slip on the ice. Falls received as a result of slipping on the ice account in great measure for the large number of cases of abortion during the winter season.

Rough handling is another very common cause for the sow aborting. This may occur in ringing, loading in wagons, or while handling the animals for the purpose of injecting with hog-cholera serum. When using serum in pregnant sows they should be handled by means of a rope slipped into the mouth, and the serum injected in the loose tissue back of the ears.

In connection with the use of serum and its relation to abortion it might be well to again consider the danger of producing abortion from use of hog-cholera serum. In the experience of the author no case of abortion has been seen following the use of the serum that could be directly charged to this cause. Cases will occur now and then from careless handling, but there is very little doubt that the serum itself is harmless as far as producing abortion is concerned.

Ergot and some other poisonous fungi and molds are capable of producing abortion. Especially is this the case with ergot, and where animals are allowed to pasture upon rye stubble fields abortion from eating of ergot-bearing straw may occur. Food poisoning, as from brine, washing powders, and similar substances, may result in irritation of the womb and thus cause abortion.

Abortion is also a common occurrence in the course of the various acute infectious diseases. Especially is this true with hog-cholera, and practically every pregnant sow that takes the disease will slip her pigs unless she herself dies of the disease, and even then she will frequently abort a few days before death takes place.

Infectious Abortion.—This form of abortion results from the infection of the genital passages by some specific germ, the true

Impotency in the male, especially in an old boar, may be due to disease of the prostate gland. In all cases of impotency in male animals, and especially those that are due to disease of the prostate gland, fluidextract of saw palmetto is the remedy par excellence. Obtain about 8 ounces of a high-grade fluidextract of this drug, and feed in teaspoonful doses with the slop three times a day. Keep the boar away from the sows for several weeks while giving this treatment, feed carefully with nutritious food, and allow plenty of exercise in a clean, dry pasture, with plenty of sunlight. Marked improvement and even complete recovery can often be secured by this method of treatment. This drug is an especially valuable remedy in those cases where there is lack of sexual desire, either in the male or female animal. It is apparently a valuable sexual tonic and restorative, and produces excellent results in both man and animal. There is a proprietary form of fluidextract of saw palmetto, known under the name of Sanmetto, which, while a little more expensive, is in many cases more effective than the plain saw palmetto.

ABORTION

Varieties.—By the term "abortion" is meant the expulsion of the pigs from the womb of the sow before they are far enough developed to be capable of life. This condition occurs with considerable frequency in sows, but not nearly so common as in cows or in mares. There is one form of abortion that occurs as a result of infection of the womb and genital passages with some special germ. This form is rare in swine, but when present may attack every sow in the herd. The second form occurs in single cases from a variety of causes, and is much the more common form in the hog.

Causes.—Abortion may be due to a large number of causes. The most common is some form of injury. The pregnant sow may be injured in a number of ways, such as by a kick, or being trampled upon by other animals in the feed lot. Crawling through a small door in the sleeping pens, crawling under a fence, or through a gate may cause sufficient injury of the pregnant uterus to result in the sow slipping her litter. Where the herd is kept in crowded quarters they may pile on top of each other, and in this manner cause injuries that will result in abortion.

Exposure to cold chilling winds or sleeping in an open lot during

are likely to cause the condition. Proper feeding and a reasonable amount of exercise will also do a great amount of good in cutting down the number of cases of abortion. Handle pregnant sows with due regard to their condition, and especially use care in catching and restraining them for purpose of ringing or injection with serum. Keep the pregnant sows away from those that are coming in heat, and do not turn newly purchased hogs in with pregnant sows, as they will nearly always do considerable fighting and abortions are likely to occur.

Once the symptoms of abortion have started to appear there are two remedies that should be used freely, and in many cases these remedies will control the condition. These two drugs are viburnum (commonly known as black haw) and tincture of opium. It makes no difference whether the disease be of the infectious or the non-infectious type, these remedies, if given early, will produce excellent results.

At the first signs of restlessness and pain the sow should be removed from the balance of the herd and placed in a quiet, dark pen, where she will be protected from excitement. Teaspoonful doses of tincture of opium should be given every three or four hours for several doses until the animal is entirely over her nervousness. At the same time give fluidextract of viburnum in large amount. The drug can be administered in tablespoonful doses every hour, in a little milk, for several doses. It will quiet down the restlessness, check the contractions of the womb, and in a large percentage of cases it will carry the animal over the danger period and allow her to carry the pigs along to term without further mishap.

In cases where abortion does really take place the sow should receive proper attention for a week or ten days to prevent infection. She should be kept quiet, fed a light diet, and it is also well to add a teaspoonful of some tonic condition powder once or twice a day to the food. As preventive of infection there is one drug that is most effective. This is echinacea. A good fluidextract or the specific medicine echinacea may be used, giving a teaspoonful with the food three times a day. It is the most powerful remedy in the entire list of drugs to prevent infections after abortion or after a difficult labor. Echafolta, a more powerful preparation of echinacea, is also a valuable preparation for the same purpose.

NYMPHOMANIA (EXCESSIVE SEXUAL DESIRE)

This is a condition in which the animal is subject to excessive nervous irritability of the generative organs. The sow so affected is continuously in heat, but never becomes pregnant. She will breed every day, but never receives any benefit from it. The condition is usually due to disease of the ovary or of the nervous system. Being continuously in heat, the sow eats poorly, is constantly running herself down, and rapidly becomes unthrifty. Such an animal is decidedly unprofitable to her owner. She not only does no good herself, but excites other sows in the herd, and keeps them in a restless condition by fighting with them and attempting to ride them. Frequently pregnant sows abort as a result of being kept in the same feed lot with an animal suffering from nymphomania. The best method of dealing with these cases is to immediately dispose of the animal. If she be a valuable sow, she may be placed in a dark pen away from other hogs and kept quiet. An excellent remedy in these cases is salix nigra, which should be administered in large doses. I have relieved many cases in man and in animal by proper use of this drug. The most reliable preparation of the drug that I have been able to obtain is the specific medicine (Lloyd Bros.). Of this a teaspoonful should be given in the slop three times a day for a period of one or two weeks. Combining the use of this drug with separation of the sow from the balance of the herd will give good results in any case that it is possible to relieve. To quiet general nervousness, as well as to overcome the unnatural sexual desire, potassium bromid may also be given in ½-teaspoonful doses. In valuable brood sows of pure-bred stock it might be desirable to have a spaying operation done and remove the diseased ovary. If one good ovary can be left the animal will breed.

Male animals may also develop a condition very similar to that just described in the sow. They have an unnaturally powerful sexual desire, and are continuously riding the sows in the lot regardless of whether they be in heat or not. These cases should be treated in the same manner. Separate the boar from the sows and place him on full doses of potassium bromid and specific medicine salix nigra.

PIG-BED FEVER (INFLAMMATION OF UTERUS AND VAGINA, METRITIS AND VAGINITIS)

It is rather uncommon in the sow to have an inflammation of the womb or uterus. Inflammation of this organ is known in scientific works as metritis. Associated with this inflammation of the uterus there frequently occurs an associated infection of the passage leading to the organ, namely, the vagina. This is known as vaginitis.

Causes.—Vaginitis and metritis are especially likely to occur after a difficult delivery in which it has been necessary for the owner to give assistance. Unclean hands, cords, hooks, and other instruments used in the effort to remove the pigs carry with them dirt and germs which become the source of a severe infection. When the pigs die in the womb, and are left there to decompose, they frequently cause an infection, and leave a septic condition remaining for many weeks after they are finally thrown off. Leaving of the after-birth is another frequent cause of severe infections of the uterus and vagina. Infections of the genital tract are predisposed to by unclean pens and surroundings which make it an easy matter for disease-producing germs to enter and set up trouble. Following an abortion the animal is especially liable to develop an infection of the womb and vagina. The genital organs at this time are not properly prepared for giving birth to the young, and are not in condition to rapidly return to normal as they should. As a result, it is not difficult for germs to enter and get a quick start. These infections occurring after abortion are usually very severe in character and frequently prove fatal.

Symptoms.—Some cases of metritis are very mild in their nature and produce but few symptoms. In fact, the disease may pass unnoticed until it is found that the sow is sterile, and then, on making an investigation to determine the cause for barrenness, it is discovered that an inflammation of the womb is present.

With an attack of inflammation of the womb there is usually a history of a difficult birth, and often one that made it necessary for the owner to give assistance in delivering the pigs. Often in these cases the after-birth, or even a dead pig, remains in the uterus, to form a decomposing, stinking mass that acts as the starting-point for the infection. If the case be severe, a few hours after the birth

the sow will be noticed to be shivering with a succession of light chills. The fever goes up to 104° or 105° F. and the animal acts dull and restless. The rate of the pulse is faster than normal and the number of pulse-beats is also increased. The sow loses appetite, is often constipated, and prefers to remain buried in her nest. If she does get up and attempt to move about, she is seen to stagger and have an unsteady gait. This staggering is due to two causes: first, to muscular weakness as the result of the action of the poisonous substances absorbed from the infected uterus; second, to the local pain and tenderness in the region of the womb.

If an effort be made to examine the genital tract it will be found to be very tender and painful. The visible membranes are swollen, red, and inflamed. They are very hot to the touch, and in a short time a very foul-smelling, disagreeable looking discharge sets in. If a dead pig or the after-birth is still in the womb the sow will make frequent straining efforts to expel them. In the severe cases the infection spreads all through the womb and attacks the lining membrane of the abdomen, setting up a fatal peritonitis.

Severe infections rapidly become alarming in appearance. The fever remains high, the sow becomes very weak and stupid, all appetite is lost, and death occurs within a few days.

In the more mild cases the discharge from the genital tract is the principal symptom. Fever, loss of appetite, and weakness are often so slight as to be overlooked. These cases, however, often hang on for weeks, and the animal may loose weight, become unthrifty in appearance, and very commonly will not breed during the time that the inflammation persists.

Treatment.—This disease is one that is much more successfully prevented than treated after it has made its appearance. It is highly essential that the farmer and stockman should understand the importance of having this disease in mind. Pig-bed fever is a very serious condition and causes severe losses. Whenever it is necessary to give a sow assistance in a difficult birth, make sure that the hands are perfectly clean before starting to handle the case, and any wires, cord, hooks, or other materials used in the operation should be made perfectly free from germs by boiling if possible. Gentleness and caution should be exercised in order to prevent tearing or otherwise injuring the genital passages.

When a delivery has been long drawn out and difficult, and has made it necessary to give assistance, it is a wise precaution to assume that inflammation is likely to occur, and handle the case accordingly. For the purpose of preventing and checking pig-bed fever, or any inflammation of the womb, there is no medicinal substance as effective as echinacea. In these cases do not wait for the fever to start, but begin the next morning to give echinacea or echafolta in teaspoonful doses. It will prevent a large number of these cases and save many valuable brood sows that would otherwise be lost.

When the infection has got a good start and is making rapid headway the case offers a severe problem in treatment. If the germs present are of an active death-producing type the case is a desperate one and the chances for saving the sow not much better than even. She should be at once removed to a clean, comfortable, warm box-stall where she can be kept quiet. Diet should consist of milk, soft mashes, and slop. It is good practice also to give a dose of calomel to clear out the bowels and keep them free from poisonous materials.

If a dead pig or a part of the after-birth remains in the womb an effort should be made to remove same if possible. The cavity of the womb may now be irrigated with a weak solution of some of the coal-tar disinfectants, such as a 1 per cent. solution of kresol.

As to the use of these irrigations of the uterus my opinions are at variance with those of most authors. I do not favor the use of injections into the womb in septic infection, but rather keeping the animal quiet, combating the poisons in the blood, and sustaining the strength of the patient as much as possible.

As an active agent to work against the effects of the germs and their poisons I think there is nothing that can be used that is more effective than echinacea. This remedy intelligently used will save many sows that would otherwise have died. It should be given, however, with a free hand, using the full strength fluidextract or specific medicine and giving a teaspoonful every two or three hours. If the fever is high, small doses of tincture of aconite, say 5 drops to the dose, may be added with benefit. Bitter tonics, such as nux vomica and gentian, may be also given with the food, but these are better withheld until after the temperature is down

to normal, when the sow should be given a small dose of a tonic condition powder with the food every morning for several days until she has fully regained strength.

INVERSION OF UTERUS

This is a complication or accident that may occur following birth. The inversion proper consists in a telescoping of the uterus through the external genital canal, and the organ becomes turned inside out or inverted, hence the name "inversion of the uterus." This is a much less common occurrence in the hog than in the cow and mare, where inversion is rather frequent. In sows it is only a part of the uterus which protrudes, as a rule, and it is exceedingly uncommon to have a complete inversion.

Causes of inversion of the womb are usually a severe, prolonged, difficult birth, with powerful contractions, which continue after the contents have been expelled. Severe injury or tearing of the external genital canal may also predispose to the production of an inversion.

Symptoms.—The principal symptom, and the one on which diagnosis is made, is the presence of a tumor-like mass protruding from the vagina or, in complete cases, hanging down below the vulva. As a result of the pressure from the mass in the vagina the bladder is unable to empty itself and becomes distended with urine, which adds to the discomfort of the animal, and the difficulty of replacing the womb to its normal location when treatment is attempted. The prolapsed womb becomes enormously congested and swollen if the prolapse is allowed to remain untreated for any length of time, and in neglected cases which go several days without relief the organ becomes infected, decomposed, and may even rot off from gangrene. In these cases there is a horrible stink thrown off by the decomposing tissues.

General symptoms may be mild or severe. In some cases an animal suffering from inversion of the uterus may eat well, move about, and show but little discomfort. In other cases the sow will have a high fever, be dull and stupid, lose all appetite, and may even die from generalized infection and absorption of poisonous materials.

Treatment.—Preventive treatment consists in carefully watch-

ing sows after a difficult birth. If the pains and straining continue after the pigs have all been delivered, make certain that a dead pig or an after-birth is not remaining in the uterus. If the organ appears to be empty, give agents that will check these severe contractions. Viburnum and opium, given as directed under the treatment of abortion, are reliable agents. The viburnum opulus, however, rather than the viburnum prunifolium should be used.

If the sow is not seen until after the uterus has slipped out, the indication now is to return it to its normal position as quickly as possible. It is a good plan before starting to work on the uterus to empty the bladder if it be distended with urine. In some cases this will be impossible. The first step in the handling of the everted womb is to thoroughly wash off any dirt or other contamination that may be on its surface. This should be done with a weak solution of one of the coal-tar disinfectants. When this is accomplished the organ should be firmly wrapped with strips of muslin bandage about 1 inch wide, commencing at the lowermost part of the tumor mass. This forces the blood out of the womb and reduces its size, making it much easier to return the organ to its natural position.

After the organ has been cleaned and wrapped it should be pushed back into place. This is best done by taking a clean finger or thumb and shoving forward against the center of the prolapsed mass. In this way the uterus is returned to its normal position and shape and reinverted, so as to bring it back into natural relation with itself.

When the uterus is back in place it is necessary to take some precautions to prevent it slipping out again. This is done by placing two or three stitches across the vulval opening so as to make it impossible for the tumor to again get out at that point. Viburnum and opium may now be given for a few doses, to quiet the severe contractions of the womb. These cases are always likely to be followed by a severe infection, and it is wise precautionary treatment to administer echinacea for several days to combat general infection.

In those cases that have been neglected, and where the uterus has become decomposed and gangrenous, it is advisable to simply amputate the organ, check the bleeding by stitches, and return the

stump to the vagina. These cases are rare in the sow, but when met with offer a very serious problem, and should be handled only by a skilled veterinarian.

INFLAMMATION OF MAMMARY GLAND (MAMMITIS, GARGET)

Inflammation of the udder, or mammary gland, is a very common affair in the sow. This is especially due to the fact that in heavy sows that are good milk producers the engorged udder or mammary gland drags close to the ground and is frequently bruised and wounded by stones, sticks, frozen ground, and other objects. This close contact with a dirty feed lot also makes it possible for large numbers of germs to enter the teats and work their way up the milk ducts to produce a severe inflammation of the gland itself.

Pigs that are rooting around in the filth and dirt of unclean feeding floors, swill troughs, and manure piles carry infection to the teats, and from there the germs soon reach the deep portions of the gland. One very interesting case has been referred to in the section on Hog-cholera Serum in which a litter of young pigs, rooting in a pile of pus and corruption emptied from an abscess cavity, carried the germs to the mammary glands and produced multiple abscesses in the udder.

Sows that lose a part or all of their litter and who have a large supply of milk are especially likely to develop a diffuse inflammation of the mammary glands.

Inflammation of the udder may be only simple in nature, with hot, painful swelling, but without the formation of any pus or abscesses. On the other hand, the condition may be a deep-seated pus infection with multiple abscesses and even ulcers.

Symptoms.—The inflamed udders become swollen, hot, painful, and very tender to the touch. The tenderness may become so marked that the sow will not allow the pigs to suck on account of the suffering produced. There is also usually a considerable rise in temperature, loss of appetite, and constipation. The milk is often changed in character, and may produce symptoms of scouring in the litter.

Treatment.—Preventive treatment consists in keeping sows and litters in clean feed lots, and in this manner lessen the chances

for infection. Sore teats should not be neglected, as this is the usual start of an infection of the deeper tissues of the gland. These should be bathed with alcohol or a strong solution of alum, or the familiar white lotion which is extensively used for inflammation of all kinds. This preparation consists of 3 drams each of zinc sulphate and lead acetate in 16 ounces of water.

Where there are signs of inflammation present the sow should first receive a full dose of Epsom salt. Following this give a teaspoonful of the following mixture every hour or two with a little slop:

Specific medicine aconite	½ dram.
Specific medicine phytolacca	2 drams.
Water to make	4 ounces.

Phytolacca and aconite are two of the most effective agents we possess for treatment of inflammation of the mammary gland. If given as soon as the earliest symptoms are noted, there will be no severe infection and no abscess formation. If desired, ½ dram of tincture of belladonna may be added to the above prescription.

As a local application on the inflamed and swollen udders there is no agent as effective as belladonna. This can be used in the form of an ointment containing ½ dram of extract of belladonna to 2 ounces of vaselin. An equal amount of gum camphor may be added to this ointment and will increase its value. It must be remembered that belladonna checks the secretion of milk, and if applied for several days may entirely check the flow.

It is a good plan in sows that have lost their litters to try and get them to adopt some of the pigs from an overlarge litter that some other sow may have. If this is not considered advisable, the udders should be milked out once or twice a day for a few days, and following each milking a thorough application made of the belladonna and camphor ointment.

When an abscess of the udder forms, the proper method of treatment is to incise the gland with a clean, sharp knife which has been sterilized by boiling. After the pus pocket has been opened up and the pus freely drained out, paint the inside of the abscess with full strength tincture of iodin.

DEFICIENT MILK SUPPLY

It is uncommon in the sow to find one that does not have enough milk for her litter if the feeding ration is properly balanced. Deficiency of milk is almost always traceable to too much dry feed and not enough of the soft foods, slops, and green feed. Nursing sows have a heavy drain upon the system, and should be well fed with a proper ration during the entire period up to weaning. In this manner the sows at weaning time are in fairly good condition, and it does not require much additional crowding to get them ready for the market.

Another danger of improper feeding during the period of lactation consists in lowering the resistance of the animals to infectious diseases, and in this way opening the door for hog-cholera germs to enter.

INFLAMMATION OF TESTICLES (ORCHITIS)

This disease of the boar is not of very common occurrence. It is somewhat more frequent in the past few years on account of the occasional spread of an inflammation following the injection of hog-cholera serum.

Causes.—Inflammation of the testicles is practically always the result of an injury, such as a blow from a club, in attempting to drive the animal, or a kick. Other sources of injury are bites received during breeding or in fighting with other hogs. Inflammation of any of the surrounding parts may spread to the scrotum and involve the testicles. As has just been mentioned, this may in some cases follow the injection of hog-cholera serum into the muscles of the hind leg.

Inflammation of the testicles may occur as a complication of some of the infectious diseases. For instance, it is quite common in hog-cholera for boars to have an orchitis which may leave the animal sterile and worthless for breeding purposes.

Symptoms.—The prominent symptoms of an inflammation o the testicles are mostly local. The testicles are swollen and the scrotum may be very much enlarged, due not only to the swelling of the testicles, but also to the collection of a considerable amount of fluid in the sac. The inflamed organ is quite painful and very tender and hot to the touch.

Constitutional symptoms are also quite pronounced in severe cases. The temperature is elevated, appetite is lost, and constipation usually is noted. The animal shows a considerable amount of dulness, and prefers to lie quiet rather than move about to any extent. When he attempts to walk the gait is stiff and straddling, and every step causes considerable pain.

In some cases the inflammation becomes a chronic one, and the testicles remain swollen, hard, and knotty to the feel, although the heat and tenderness may entirely disappear. Following a severe orchitis, if both testicles were involved, the animal is usually worthless for breeding purposes. The changes produced by the inflammation cause closing up of the small canals which carry the semen of the animal, and, as a result, he is unable to properly manufacture this necessary fluid and is of no service.

If the case be a very severe one the inflammation may go on to the development of an abscess, which will entirely destroy the testicle of the affected side in many cases.

Treatment.—Preventive treatment consists in careful handling of boars and restraining any inclination to get rough with them when driving, ringing, or otherwise handling them. In the injection of hog-cholera serum in boars it is a wise plan to make the injection in the loose tissues back of the ear or foreleg rather than in the muscles of the thigh. In this way the danger of spreading inflammation to the scrotum is avoided.

If an orchitis is seen early in its course, the best procedure is to give the animal a large dose of Epsom salt, and follow this with the aconite and phytolacca mixture mentioned in the treatment of inflammation of the udder. Full strength phytolacca may also be applied locally over the inflamed organ. In many cases this method of treatment will abort the condition. It is also wise in these early cases to apply wet cloths wrung out of ice-cold water.

In the more severe cases that are not seen until later in their course the aconite and phytolacca are again useful, but the local application of cloths wrung out of hot water is now more effective than those wrung from cold water. Local application of a belladonna ointment or painting the scrotum with a solution of guaiacol is also very effective in relieving pain and inflammation in these severe cases.

It is hardly necessary to add that the boar should be removed from the rest of the herd and kept quiet for several days. The diet should be of a light, sloppy nature and contain plenty of liquid.

After the acute inflammation has subsided, if there is any tendency to induration and hardening, applications of iodin should be made. Lugol's solution makes an excellent application in these cases. It contains iodin crystals, 1 part; iodid of potassium, 2 parts; water, 20 parts. This should be applied freely every day. Internally, 20 gr. of iodid of potassium may be given with the feed every morning. This will hasten absorption of any exudate formed and in many cases prevent sterility.

HYDROCELE (WATER IN THE SCROTUM, WATER SEED)

Causes.—Water seed is rather an infrequent condition to meet with in the hog. It consists of a collection of a water-like fluid in the scrotum, and is due to an inflammation of the covering membrane of the testicle, which is known as the tunica vaginalis. The hydrocele may be a result of an injury to the testicle or scrotum, as in the case of orchitis—a condition which it often complicates. In like manner, after injection of serum, fluid may be formed in the scrotal sac.

What is commonly classed as a water seed follows careless castration in which the tunica vaginalis is left behind. This forms a sac which secretes a watery fluid that collects as a water bag or water seed. The water seed is much more common in horses than in hogs.

Symptoms.—The only symptom noted, and the one by which diagnosis is made, is the presence of a large, soft, fluctuating tumor in the region of the scrotum. This swelling is more marked at the lower border of the scrotum, and, when taken hold of with the hand, is found to be painless and filled with fluid. If this be tapped the fluid will run out, but it re-forms, and the swelling thus recurs in a few days.

This condition differs from the scrotal swelling seen with orchitis, in that it comes on more slowly and is painless in character. It is also unaccompanied by any symptoms of fever, depression, or loss of appetite.

Treatment.—As far as any danger to life is concerned, the condition may be left untreated. It produces but little inconvenience

to the hog unless it becomes very large. It does, however, make a bad blemish, and it is often desirable to remove it. Before starting any treatment the tumor mass should be carefully examined, to make sure that it is not a rupture instead of a collection of fluid. This can be done by carefully palpating the swelling and working it between the thumb and fingers. If there are loops of gut present they can be made out quite distinctly from a mere collection of fluid.

If treatment is decided upon in the case of an uncastrated animal a small trocar and cannula should be obtained and sterilized by boiling. This is now plunged through the skin of the scrotum and the fluid allowed to drain off through the cannula. After the fluid has all come away, and while the cannula is still in the sac, tincture of iodin should be injected through the tube and this thoroughly worked around inside the sac. The iodin acts as an irritant and sets up an inflammation which closes the empty space and prevents recurrence of the fluid collection. In some cases the entire sac is not destroyed at the first injection, and it may be necessary to repeat the operation a few weeks after.

In case of a castrated animal with a water seed the proper treatment consists in opening into the scrotum and dissecting out the sac, tying it across at its upper end, and with a sharp knife or scissors cutting the sac away and removing it.

HEMATOCELE (BLOOD IN THE SCROTUM)

Hematocele is a condition very similar to water seed, except for the fact that the fluid present in the scrotum in this case is blood instead of water or serum. It is especially likely to occur after severe bruising injuries to the scrotum or testicles. The symptoms and treatment do not differ materially from those given for hydrocele.

INFLAMMATION OF SHEATH

Causes.—In the male animal accumulation of secretions and dirt in the sheath and the folds of its lining membrane may cause a quite severe degree of irritation, and finally set up an inflammation. Pus germs enter and bury themselves in the glands that line the canal. They begin the formation of pus, and it is only a short time

until a severe type of inflammation develops, and with it often the formation of abscesses.

Symptoms.—The principal symptoms are local. The prepuce and the surrounding sheath tissues become swollen, painful, tender, hot, red, and angry in appearance. The swelling of the sheath may so encroach upon the canal that there is considerable difficulty in passing the urine. The urine passing down over the inflamed tissues produces a quite severe irritation and pain.

If the animal be restrained, and an effort made to examine the diseased sheath, it will be found that the swelling is very hot and tender, examination causing the animal to show signs of a considerable degree of pain. When squeezed upon, the swollen sheath is found to be filled with a disagreeable looking, foul-smelling, cheese-like substance, which is the decomposed retained secretions of the sheath.

In those cases where the disease interferes with the flow of urine there may be secondary symptoms produced, which are those of retention of urine. The bladder may be found to be distended and filled with urine and marked constitutional symptoms may develop.

Treatment.—The animal should be thrown upon his back and firmly held by a couple of assistants. Add enough of one of the tar disinfectants to a pail of hot water to make about a 2 or 3 per cent. solution, and with a clean cloth carefully wash the region of the sheath, and remove all accumulated secretions and dirt from around the preputial opening.

The collection of decomposing material in the sheath itself should next be removed. This may be accomplished by introducing the finger through the opening and carefully breaking down and scraping out the mass of material found within. To make a thorough cleansing it is best to introduce the nozzle of a syringe and carefully irrigate the canal with the disinfectant solution. It is highly important that this accumulated material be thoroughly removed, and, if necessary, the opening in the front of the sheath should be enlarged by making an incision at one or both lateral margins.

After everything has been once thoroughly cleaned out, it is advisable to irrigate the sheath daily for a week or two until the condition returns to normal.

SURGICAL DISEASES

In a work of this nature it is impossible to go much into detail of surgical procedures. In the hog, surgical operations, except castration, are not very common. There is a large amount of room for development in this branch of veterinary surgery, but it is within the province of text-books upon the subject of surgery rather than a work of this character to discuss the various surgical procedures that are suited to the hog. Some of the more common surgical conditions met with in hogs and the proper method of handling them will, however, be taken up briefly in the following pages.

CHOKE (OBSTRUCTION OF ESOPHAGUS)

This condition, which might be well regarded as a surgical one in that the treatment is largely surgical rather than medicinal, has already been discussed under the head of Diseases of the Esophagus, and will be found in that section.

RUPTURE (HERNIA)

Rupture, or hernia, is a quite common accident in the hog, especially in growing pigs, and is one that is worthy of consideration, as a great amount of good can be done in the treatment of rupture if the start is made early enough.

By a rupture is meant a condition in which a coil of the intestines or a part of the abdominal fat protrudes through the abdominal wall, and lies superficially beneath the skin. The opening through which the contents of the rupture escape may be quite small, but enough of the bowel or omental fat may escape to form a large-sized tumor.

Rupture occurs, as a rule, at those points on the abdominal wall where there is a weak spot. Most common locations are the scrotum and the region of the navel or umbilicus. At the scrotum hernia occurs through the inguinal canal, which is the passageway

for the cord that holds the testicle in place. A loop of gut may pass out alongside this cord and find its way into the scrotum. More and more of the gut reaches the bag in this manner, until a large tumor mass forms which may become as large as a man's fist or even as large as a child's head.

Rupture at the navel occurs as a result of the weakness left at that point when the navel becomes detached. This form of hernia is especially common in young growing pigs, and may vary in size from that of a walnut to as large as a small melon. This form of rupture often becomes so large that it drags on the ground, and in this manner becomes irritated and inflamed.

A rupture in the region of the scrotum is known as an inguinal or scrotal hernia, on account of coming through the inguinal canal into the scrotum. Rupture in the region of the navel is known as an umbilical hernia, on account of the fact that it passes through the opening left by detachment of the umbilical cord.

Hernia sometimes occurs in other parts of the body, as through the scar of a surgical operation, such as a cesarean section, but such forms of rupture are very uncommon in the hog. Scrotal and umbilical ruptures occur with about equal frequency, the scrotal being perhaps a little the more common.

INGUINAL OR SCROTAL HERNIA

This hernia is a form of rupture in which the intestine passes out through the inguinal canal and enters the scrotum. The condition may occur as a one-sided or single, or as a two-sided or double, hernia. The single hernia is the one most commonly seen. This form of hernia is, of course, seen only in male animals.

Causes.—The principal cause for an inguinal rupture is the fact that in these animals the canal through which the cord passes is larger than it should be, and, as a result, it is possible for a loop of the bowel to pass through alongside the cord and enter the scrotum. At first only a small loop enters, but a little later more and more of the gut pushes its way in, and the opening becomes larger and larger, until a large mass of bowel and omentum are to be found in the scrotal sac. The rupture may occur either before or after castration. More commonly the rupture occurs before castration. Rough handling or unskilful performance of the op-

eration may cause rupture to make its appearance soon after the pig has been cut.

Other causes for rupture are overcrowding of pigs, causing them to pile up on each other and strain themselves. Continued constipation and chronic bronchitis are also causes for rupture, in that they result in continuous straining. Injuries received in crowding through a doorway, partly opened gate, or a hole in a fence may also result in such injury as to cause development of a rupture.

Symptoms.—The principal symptom is the development of a tumor-like swelling in the region of the scrotum. This at first may be small, but continues to increase in size until it may become so large that it drags upon the ground. The swelling is painless, and remains so until it begins to drag upon the ground, when it may become inflamed, ulcerated, and painful. The pig at first shows no bad effects from the presence of the rupture, but, as it becomes larger, the drain upon his vitality makes itself apparent. Digestive disturbances develop, the animal stops gaining in weight, and in the course of a few months becomes a chronic runt.

If the pig be caught and held up by the hind legs the contents of the tumor sac disappear, passing back through the enlarged inguinal canal into the belly where they belong. When the pig is placed upon his feet again and allowed to run around the rupture comes down again just as large as ever. If the rupture is carefully palpated between the fingers the loops of intestine can usually be plainly felt, and the testicle is to be found in most cases at the bottom of the scrotum under the mass of intestines. The rupture is painless, and the animal does not give any evidence of pain when it is being examined.

Treatment.—There are two principal methods of handling these rupture cases: one is by the so-called closed or covered operation, the other by the open operation. Of these two procedures, the covered operation is the more simple and the most effective. In either case, it is necessary that the animal be castrated.

The Covered Operation.—In performing this operation it is necessary to have a needle, a ligature, an operating knife, and a pair of scissors. All of these utensils should be made perfectly free from germs by boiling in water. These instruments should be

kept in a 3 per cent. solution of one of the tar disinfectants while not in use.

Directions for Operating.—The pig should now be caught and held up by the hind legs with the head down. This gives opportunity for the intestines in the rupture to pass back into the belly. The scrotum should now be washed well with 3 per cent. creolin solution or a solution of equal strength of any of the other tar disinfectants. It should then be washed off with alcohol and painted over thoroughly with tincture of iodin.

With the knife now make an incision into the scrotum down to the tunica vaginalis of the testicle. This is the outer covering of the testicle and is recognized by its shiny appearance. The opening in the scrotum should be a fairly good-sized one, and should be large enough to permit of drawing the testicle and its coverings out through the incision so as to be able to see what you are doing. The cord and coverings are drawn down as far as possible, and a needle carrying a ligature is passed through the cord and its membranes just as high up as possible. The needle is then removed and the ligature tied tight. With the scissors the cord is now cut off about ½ inch from the ligature. The testicle which has now been severed from the cord is removed, the opening in the scrotum may be partly closed by a couple of stitches, and the animal is allowed to escape. By this operation the sac is tied off and the abdominal cavity completely closed. This prevents any chance of the rupture returning.

The Open Operation.—In this operation the animal is held up by the hind legs, and the rupture returned to the abdominal cavity as before. The same precautions should be observed with respect to thoroughly cleansing the scrotum and sterilizing the instruments by boiling. The incision is made in the scrotum and the cord ligated and cut, with removal of the testicle. The operator now takes several stitches in the muscles around the external opening of the inguinal canal in order to make the closure more complete. One or two stitches are then taken in the scrotum to partially close the incision made on removing the testicle. This operation requires more skill than the covered method and the results are not much more satisfactory; in fact, many operators report better results from the covered operation than where the open method is used.

UMBILICAL HERNIA

This is the form of rupture seen where protrusion of a part of the intestine takes place at the location of the navel, and is due to imperfect closure of the opening left after the umbilical cord stump dries up and falls off. The rupture is usually present at birth or occurs very soon afterward. At first the tumor may be small, but as the animal gets older the rupture grows larger, until finally it becomes so large that it may drag upon the ground. The swelling is recognized as a rupture by its location, by the fact that it is painless and free from inflammation, and when the pig is placed on his back the intestinal loops in the swelling can be felt. By a little manipulation they may be forced back into the abdominal cavity and the ring-like opening in the belly wall can be felt. In a long-standing case this opening is often so large as to admit three or four finger-tips or even the entire hand.

Umbilical hernia early shows its effects on the general health of the pig, and the animal quickly becomes stunted and fails to grow like the balance of the litter.

Treatment.—The treatment of an umbilical hernia is very simple, and is usually followed by excellent results. It is, indeed, to be regretted that this operation is not more extensively used by veterinarians and stockmen. Very frequently these cases of umbilical hernia are allowed to drag around neglected until they reach a stage where they have become practically worthless and hopeless. The time to treat the case is while the tumor is small and while the opening through the belly wall is not large. The smaller the tumor, the better the chance for success in handling the case.

The Operation.—There could be nothing more simple than the operation for treatment of an umbilical hernia. The animal should be placed on the back and held by one or two assistants. The skin over the tumor mass should be carefully scrubbed with soap and water or with a 3 per cent. solution of one of the tar disinfectants. By simple pressure with the fingers, assisted by gentle manipulation if necessary, the intestinal coils are returned to the abdominal cavity. The sac is now taken hold of by an assistant and pulled gently, so as to put it on the stretch. A strong cord is then passed around the base of the tumor sac and tied as tight as it

can possibly be drawn. Before doing this, however, make sure, by careful examination and palpation, that the sac is empty, and that it does not still contain one or more loops of intestine. If a part of the gut be included in the sac when it is tied off the outcome will be most undesirable, and death of the pig will probably follow from gangrene of the bowel and peritonitis.

This cord which has been tied around the sac causes the surrounding tissues to swell, and this closes the opening in the floor of the abdomen. At the same time the tightly drawn cord stops the flow of blood from the blood-vessels into the tissues of the sac and this appendage dies and sloughs off. Fibrous tissue now closes up the opening and the animal is well.

In cases where the rupture is large this simple method of ligature is hardly sufficient, and it is necessary to make a double or multiple ligation. This is accomplished in a very simple manner. The sac and the skin of the surrounding region are carefully cleansed as before. The sac is emptied as before and a heavy linen thread or ligature threaded in a needle is carried through the base of the sac. The thread is then divided and each half tied separately. In this method the needle is threaded with a double thread. Instead of this, a single-thread ligature may be used and passed through in two points close together, and each tied separately on the opposite sides. In this manner each thread ties off one-half of the sac. It is well to have the assistant pull up gently on the hernial sac so as to place it a little on the stretch. In this manner it is possible to get the stitches quite close to the belly wall.

With some of the old, long-standing cases it may be impossible to return the contents of the hernial sac into the abdominal cavity, due to the fact that they have adhered or grown fast to the wall of the sac. In these cases it is necessary to carefully open into the tumor sac and break down these fibrous bands of adhesion. The gut is then returned to the abdominal cavity and the edges of the opening stitched across from side to side. This is quite a difficult operation, and should be attempted only by a skilled veterinarian.

VENTRAL HERNIA

By far the more common forms of hernia in the hog are the scrotal and the umbilical. In both of these cases the intestine es-

capes from the abdominal cavity through an abnormally large natural body opening. In the case of the scrotal hernia the bowel comes out through the inguinal canal which is the natural passageway for the cord of the testicle. In the umbilical rupture the hernia escapes through the opening at the navel or umbilicus. In the pig at birth this is a natural opening. After birth this canal should close, but in those cases where a rupture occurs it fails to do so, and is left as a permanent passageway through which the bowel escapes.

In comparatively rare cases rupture takes place through breaks in the abdominal wall that are made in another manner. In these cases the rupture occurs at some point of injury, where, as a result of a blow, a kick, or a cut, there is left a weak place. For example, in sows after a cesarean section a rupture may take place at the site of the scar. This scar tissue is not as strong as the natural muscle tissues that have been cut in the operation, and it may stretch so as to allow of the escape of the contents of the abdominal cavity into a pouch-like sac that will be formed beneath the skin. Herniæ of this kind are known as ventral herniæ. They differ from the inguinal and umbilical herniæ only in that they escape through an unnatural instead of a natural opening in the body wall.

Other common causes for ventral rupture are injuries with blunt objects, kicks from larger animals, and tearing of the muscle tissues by sudden falls. Straining and injury due to overcrowding is another frequent cause. Animals that are in poor condition are especially liable to develop rupture as a result of some unusual accident.

Symptoms.—The symptoms of a ventral rupture are very much the same as in the case of the umbilical and inguinal types. There is noted a painless swelling at some unusual point on the body, and when this swelling is examined it is found to contain loops of intestine. If the animal be placed in proper position, and a little manipulation made, it will be found that these portions of bowel slip back into the abdominal cavity and a ring-like opening can be felt at the bottom of the sac.

This form of rupture, occurring as it does through injury to the walls of the abdomen, is frequently accompanied by a considerable degree of inflammation, and as a result it is often found that

adhesions form between the walls of the sac and its contents. These bands of fibrous tissue firmly attach the bowel to the sac and it now becomes impossible to return the gut to the belly.

Ventral hernia may appear on any part of the abdominal wall, but is seen more commonly on the inner side of the flank, and the sac may bulge back into the scrotal region and give a close resemblance to an inguinal hernia. In some cases the rupture passes out through the same opening as the large blood-vessels of the hind leg, and a rupture of this type is properly classed as a femoral hernia.

Treatment.—As in other forms of rupture, the treatment of a ventral hernia is purely surgical. Results, however, in the case of these unusual ruptures are not so good as in the other forms. There is usually difficulty in getting the bowel loose from the walls of the sac and considerable difficulty in securing a proper closure of the opening. Where this form of rupture occurs as the result of an accident to an animal that is in fit condition for market, and which does not possess unusual value for breeding purposes, it is perhaps as good a plan as any to send the hog to market rather than to try and relieve the condition by operation.

In operation for repair of a ventral rupture it is necessary to go through the same preparatory steps as in other classes of rupture. Knives, needles, sutures, and everything else that are to be used should be carefully boiled and kept in an antiseptic solution when not in use. The hands should be very carefully scrubbed, and the skin over the ruptured sac given the same thorough cleansing as in the case of a scrotal or umbilical hernia.

An incision is now carefully made into the sac and the fingers of one hand introduced. With these fingers the bands of adhesion that attach the bowel to the sac are broken down and the gut forced back into the belly. The hog should be held in such position as will make this as easy as possible. The best position usually is to have the animal on its back with the hind legs slightly elevated.

After the gut has been returned to its normal position a ligature should be passed around the sac as close to the abdominal wall as possible, firmly tied, and the empty portion of the sac cut off. Several closely placed stitches should now be taken in the muscles surrounding the hole and these tightly tied, so as to close the edges

as firmly as possible. Some operators consider it good practice to scrape the edges of the opening with the back of the knife before stitching them in order that more new tissue will be formed in the healing of the wound. This is perhaps a good plan, especially if the hole be a large one.

The edges of the skin wound should now be stitched together, or, if desired, this wound may be packed with gauze, which should be replaced with fresh material each day. The hog should then be placed in a clean pen and kept away from the balance of the herd until completely recovered.

This operation offers a considerable amount of difficulty, and, as the conditions found are not exactly the same in any two cases, it would be a risky one for the owner to undertake. If it is considered advisable to treat these ventral ruptures, a skilled veterinarian should be called, as the conditions met with in these cases are such as can be handled only by a man with a thorough knowledge of the anatomy of the parts and of proper surgical procedures.

PROLAPSE OF THE RECTUM

Definition.—This is a rather uncommon condition, in which there is a protrusion or prolapse of the lining membrane of the rectum through the anal opening. The condition is met with most commonly in young shoats and growing pigs about the age of weaning or shortly after. It may occur, however, in hogs of any age under those conditions which favor its production.

Causes.—The most frequent cause of prolapse of the rectum is constipation. As a result of the difficulty in moving the bowels the animal strains repeatedly, and finally forces a part of the bowel out through the anus. In like manner, a severe diarrhea may result in prolapse. In these cases the exhausting discharge so weakens the sphincter muscle that guards the anal opening that it becomes relaxed and the bowel prolapses or slips out.

Pigs that are allowed to feed around a coal pile or on a cinder bed are often subjects of prolapse of the rectum. It is also met with in many cases of perverted appetite where pigs eat rotten wood, earth, and other similar indigestible materials.

Symptoms.—The symptoms of prolapse of the rectum are somewhat similar to those of eversion of the uterus, but much less

marked. In some cases the prolapse is only noticed when the animal strains in attempting to empty the bowels, and in these cases there is only a small amount of the membrane protruded through the opening, and this usually returns to its regular position in a few minutes after the straining has been stopped.

If the case be more severe it is not unusual for a fairly good-sized tumor to be seen in the region of the anus. This swollen mass is round, red, or dark-purple in color, and may be somewhat painful when handled. The longer it remains exposed, the larger it becomes and the more dark in color it appears. Finally, it may become dry and show deep cracks or fissures on its surface. The prolapsed part may itch very severely, and as a result the hog rubs it against fence posts, the walls of the shed, and other convenient objects, producing a more severe inflammation and often severe injury to the parts.

When allowed to remain untreated the animal loses appetite, becomes feverish, and loses weight. The tumor-like mass finally decomposes and may slough off if not taken care of.

Treatment.—Prevention consists principally in proper attention to constipation and other digestive disorders. A mild laxative given to the bound-up animals will empty the bowel of accumulated dry fecal material and stop the straining efforts. In like manner, diarrhea, perverted appetite, and intestinal worms should all receive proper attention in order that severe consequences may be afterward avoided.

Where prolapse actually exists, the protruding portion of the mucous membrane should be carefully cleansed with a warm antiseptic solution or with warm water and soap. If badly inflamed and swollen it may be washed with a 5 per cent. solution of alum or with a 4 per cent. solution of cocain. The cocain may well be applied after the alum has been used. It relieves the irritation and will allow of the bowel being easily replaced.

After the tumor mass has been returned to its natural position it is necessary often to use some artificial means of keeping it from again coming out. This may be accomplished by taking one or two stitches across the anal opening, which may be left in position for a couple of days, or a suppository containing 1 gr. of aqueous extract of opium may be pushed up into the rectum once or twice a day.

CESAREAN OPERATION

In some cases of difficult delivery in the sow it may become necessary, in order to save her life, to perform this operation, which consists in making an incision in the flank and removing the pigs by cutting into the uterus and taking them out with the hand or forceps, after which the wound in the uterus and flank are closed.

The operation is a somewhat difficult one, and yet one that is much less dangerous than generally supposed. It derives its name from the fact that the great Roman emperor, Julius Cæsar, is popularly believed to have been born in this manner. The operation is one of sufficiently great magnitude that it should hardly be undertaken by the farmer or stockman, and especially not so nowadays, when skilled veterinarians can so easily be obtained.

In performing the operation it is desirable to place the sow on her back upon a table or box, which is so elevated at one end as to place the hind quarters somewhat higher than the front part of the body. It is a good plan before starting to operate to irrigate the external genital organs with a solution of weak bichlorid of mercury or boric acid solution, and also to empty the large bowel by an injection of soap and water. In an emergency this can be neglected without doing any great harm.

The first step in the active part of the operation consists in thoroughly scrubbing the flank where the incision is going to be made with soap and water and a stiff brush, if one is at hand. After thoroughly cleaning the part, it should be bathed in alcohol and then painted freely with tincture of iodin, which is allowed to dry for about a minute before the cut is made. In performing this operation it is desirable to have one large knife, which is used for the incision through the skin, and a smaller knife, which is used for the after operative incisions. Several needles of the curved and straight type should be ready, and also sutures of catgut and linen, as well as numerous forceps to grasp bleeding vessels.

If convenient an anesthetic may be given, ether being the preferable drug for use. This makes the work much easier, and should be given wherever possible, but is not absolutely necessary, as the work can be done under restraint without the use of any anesthetic in an emergency.

Everything being in readiness, the large knife is taken and an

incision made in either the right or left flank. This cut should be about 6 or 8 inches long. Sterile hooks are now introduced in the margins of the wound and the fat pulled to one side. The small knife is then taken, and an incision made through the shiny peritoneal lining of the abdomen. This exposes the contents of the abdomen and pelvis. The hand is now introduced and the uterus located. This organ is then brought out through the incision or opening in the flank, and wrapped around with sterile towels wrung out of hot water; this for the purpose of preventing chilling. It is a good plan to pack some sterile gauze around the lips of the wound to protect the peritoneum and intestines from contamination by the contents of the uterus when that organ is opened.

An incision is now made into the dorsal surface of the uterus over the body of the organ. Bleeding vessels are quickly picked up with artery forceps and ligated with sterile ligatures to check bleeding. The contents of the uterus are now quickly removed, including both the pigs and the after-birth. The pigs in the opposite horn from that over which the incision is made can be removed by the introduction of a sterile forceps.

The uterus is then quickly closed by a continuous catgut suture, the towels and gauze removed, and the organ allowed to fall back into place, care being taken first to see that all bleeding vessels have been firmly tied. The two lips of the peritoneum are picked up with forceps and sewed together with sterile sutures. The cut in the muscles is next brought together, and, finally, the incision through the skin is repaired. The animal is then liberated or allowed to come from under the anesthetic. She should be kept quiet and in a clean, darkened stall for several days. Diet should be light, with plenty of fresh water. After-treatment consists in the use of tonics and proper attention to the wound.

It is advisable in this operation to use all reasonable speed, as it seems that the more rapidly the operation is performed, the better are the chances for recovery of the sow. In the hands of a skilful operator the percentage of sows that can be saved by this procedure is quite high, and the operation is well worth attempting, especially in the case of valuable brood sows. The peritoneum of the hog is especially resistant to infection, and, with a reasonable degree of cleanliness, the after-results will be good.

CASTRATION

By Dr. George R. White

CASTRATION OF BOARS

Definition.—"Castration" means unsexing the male, and consists in removing both testicles.

Objects of the Operation.—Pigs are castrated in order to facilitate their growth and fattening. Aside from the above, the operation has a tendency to improve their behavior when associated with

Fig. 99.—Testicle: *O*, Globus major; *P*, epididymis; *S*, *T*, spermatic cord.

other hogs, especially sows. Older hogs (boars) are often castrated when, having reached the limit of usefulness as breeding animals, it is decided to prepare them for market. Even when castrated boars never make choice meat. However, they take on flesh (fatten) very readily, and their characteristic odor disappears to a decided degree. Castrated boars are known as "stags." Cas-

trated pigs are referred to as "barrows," and it is a well-recognized fact that "barrows" command a higher market price than boars.

Castration is an operation which is universally practised wherever swine are raised.

Age.—Pigs are best castrated either two weeks before or two weeks after weaning. If the operation is performed at or near weaning time it has a tendency to retard their growth and development. If allowed to run too long they become "boarish," besides the operation is more painful than it would have been if they had been operated on as pigs.

Fig. 100.—Restraint for castration.

Season.—Hogs should not be castrated during the summer months while flies are prevalent. Best to operate during late fall, winter, and early spring.

Anatomic Conformation and Relation of Scrotum to Testicles.—The scrotum consists of two pouches formed by skin, subcutaneous connective tissue, etc. These pouches are divided by a median line ("raphé") and fit up close to the perineal region. These pouches each contain a testicle (Fig. 99), which is decidedly shorter and more rounded than the testicle of many of the other domestic animals.

Restraint.—In castrating large boars it is necessary to take the advantage of the animal to a very decided degree. This is essential,

Fig. 101.—Restraint of large boar for castration.

Fig. 102.—Restraint for castration.

first, on account of the great strength of the animal compared to its size; and, second, on account of there being no favorable part or appendage of the hog by which a firm handhold can be taken.

Satisfactory restraint may be had by several different methods. Figure 100 illustrates casting and tying the animal by bringing three feet together. To thus secure a large hog requires considerable time and much effort, besides requiring the services of several assistants.

Fig. 103.—Holding pig for castration.

A favorite method of the writer for handling large boars for this operation is graphically illustrated in Fig. 101. It consists in placing the loop of a $\frac{1}{2}$- or $\frac{3}{4}$-inch rope over the neck and behind one shoulder, after which throw the rope over beam above, and allow the assistant to draw the fore feet of the hog off the floor by

tension on the rope. This renders the animal absolutely helpless. By such a method the operator with one assistant can handle the largest size hog.

Another quick method of restraint for operation of this character is illustrated in Fig. 102. This consists in placing a rail or bar

Fig. 104.—Holding small shoat for castration.

over the neck of the hog, where it is held by the weight of an assistant.

Figures 103 and 104 illustrate two methods of holding small shoats and pigs for operation.

Instruments.—The first essential to dexterity and satisfactory work is a good sharp knife, and I know of none better than the Williams all-metal, stiff-handle castrating knife (Fig. 105). The Williams knife is easy to cleanse, and, on account of the short handle and shape of blade, it is a desirable knife for this operation.

Fig. 105.—Williams' all-metal, stiff-handle castrating knife.

The only other instruments necessary for castrating either boars or pigs is an emasculator. The most satisfactory emasculator for this class of work is the sheep and swine emasculator (Fig. 106). This instrument is about one-half the size of the emasculator used for castrating horses and mules.

Fig. 106.—Sheep and swine emasculator.

Preparation.—No special preparation is necessary, unless it be to have the animals empty, which would lessen the danger of injury from handling.

Operative Technic.—The knife and emasculator should be sterilized by boiling for twenty or thirty minutes, after which immerse them in a pan or bucket containing 2 per cent. lysol solu-

tion. With sterile instruments, clean hands, and the animal properly secured this operation is simple and an extremely easy

Fig. 107.—*J*, Hand; *H*, *I*, incisions in scrotum.

Fig. 108.—Severing spermatic cord and its coverings with emasculator: *K*, Testicle; *L*, spermatic cord and its covering; *M*, emasculator; *N*, opposite testicle.

one to perform. The scrotum is firmly grasped and two bold incisions (Fig. 107, *H*, *I*) made.

These incisions should begin well forward on the scrotum, and extend sufficiently far backward to allow the testicle to be removed from the scrotum without effort. The larger the incision, the better. These incisions should be parallel to each other and to the median line ("raphé"). They should be from ½ to 1 inch—depending on the size of the hog—on each side of the median line. If for any reason the first incision was not sufficiently deep to penetrate the tunica vaginalis (sac covering testicle) and completely release the testicle from scrotum, then with another stroke of the knife this tunic is incised, which allows the testicle to escape from the scrotum. The testicle is now grasped with the left hand, by which it is advisable to apply about one to two pounds' tension on the cord, after which apply the emasculator, *M*, to cord and its coverings, *L*, as close to the skin or scrotal incision as possible, being careful that the instrument is at direct right angles to the cord, after which the cord is severed by bringing the handles of the instrument together (Fig. 108). The opposite testicle is now removed in like manner.

Sequelæ.—Septicemia (blood-poison); peritonitis; scirrhous cord; tetanus (lockjaw); hemorrhage.

SPAYING SOWS

Definition.—"Spaying"—scientifically referred to as ovariotomy—means unsexing the female, which consists in removing both ovaries from the abdominal cavity.

Objects of the Operation.—The one and only beneficial result of this operation is to facilitate growth, fattening, marketing, and slaughter without the handicap of early pregnancy. The economic importance of spaying is well recognized by many swine owners. Formerly the operation was more generally practised than it is at the present day. This may be accounted for by the fact that what would have formerly been termed revolutionary methods are now in vogue in the great swine-raising sections of the Middle West and Central States in raising and marketing hogs. This practice enables swine owners to grow, fatten, and market hogs as early as six to ten months of age, and is becoming more universal each and every year. Of course, under such circumstances, spaying would not be an essential operation. However, in the South and South-

west the older methods of swine-raising still prevail to a limited degree, hence it is in this section that the operation of spaying is still practised to a limited extent.

Age.—The operation is best performed at four months of age. However, it is permissible to operate any time from sixty days to maturity or even old age.

Season.—Sows should not be spayed during "fly time" or in extremely cold weather. Best to operate in the fall, early winter, and spring.

Anatomic Conformation and Relative Relation of Important Organs and Parts.—It is well to remember that the Fallopian

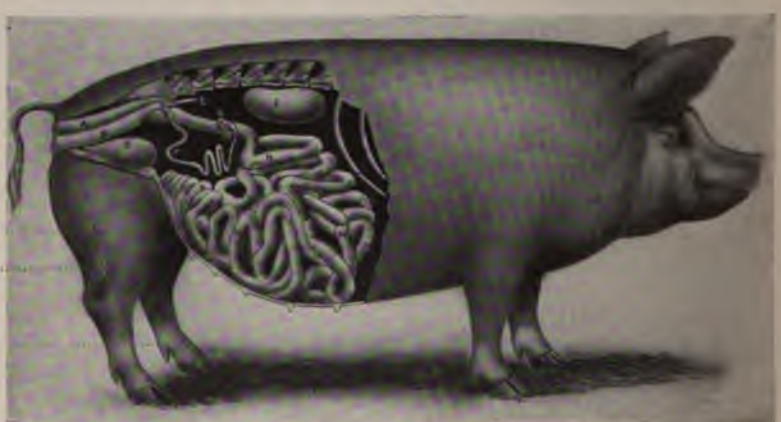

Fig. 109.—Internal genital organs of sow: *A*, Rectum; *B*, vagina; *C*, bladder; *D*, uterus; *E*, left fallopian tube or "horn"; *F*, right Fallopian tube or "horn"; *G*, ovary; *H*, *H*, *H*, intestines; *I*, kidney.

tubes ("horns of uterus") in sows are extremely long in comparison to size of animal, and that their course is decidedly tortuous in the pelvis and abdominal cavities. The importance of the above can be more thoroughly comprehended and appreciated if you will carefully observe these parts and their relation, which is plainly illustrated in a diagrammatic way in Fig. 109. The body of the uterus is unusually short when the length of its tubes ("horns") are taken into consideration. The cervix (neck of womb) does not project into the vagina in such manner as is observed in most other domestic and wild animals. On the other hand, the vagina and uterus of

the sow are continued into each other without any circumscribed limit intervening between them. The "horns" float loosely in the abdominal cavity, and are found closely associated with the convolutions of the intestines. The broad ligaments are mesenteric in conformation and character and are extremely thin and lax. The ovaries are decidedly lobulated, and closely resemble grape clusters, being suspended to the right and left of the vertebral column near the median line of the body.

Figure 110 illustrates the external as well as internal generative organs of the sow.

The abdominal wall in the flank region is quite thick and contains much fat. This fat is encountered between the skin and the external oblique abdominal muscle. More fat is encountered in mature sows than in younger hogs. The skin is dense and tough

Fig. 110.—External and internal generative organs of sow: *A*, *A*, Ovaries; *B*, *B*, Fallopian tubes or "horns"; *C*, uterus; *D*, vagina; *E*, vulva.

in consistency, while the external and internal oblique abdominal muscles and peritoneum are comparatively thin and delicate in conformation. The above description applies equally as well to the belly wall at site of spaying operation, except that the wall in the latter region is somewhat thinner.

Restraint.—Proper restraint technic is as much an essential in spaying operations as it is in most any operation in animal surgery. This operation calls for the simple and easily applied rather than the complicated and intrinsic methods oftentimes employed in other operations. The method of restraint used must, of course, depend upon whether the flank or the belly operation is to be performed.

If the abdominal cavity is to be invaded from below (belly), the most simple and satisfactory method of restraint would consist in looping a strong cord (window-sash cord) or small-sized rope above the hock, by which the animal can be readily suspended to a post or wall for operation, in the hanging posture (Fig. 110). If the flank incision is to be resorted to, then it is necessary for the animal to be confined in the recumbent posture at an angle of about 30 degrees, on either right or left side, depending upon which flank

Fig. 111.—Restraint for spaying operation (flank method): First step.

is to be invaded. One of the best and most satisfactory methods the writer has ever employed is as follows: Procure a piece of $\frac{3}{8}$-inch soft rope about 6 feet long. Tie the free ends together, forming a loop, as shown in Fig. 111.

Next secure a 2 by 14-inch plank, about 12 feet long; place one end on the floor or ground, as the case may be; either spike the other end fast to the wall or suspend it by means of a rope from

above (*B*). Now make your rope loop fast to the upper end of the plank with a screw-eye or a spike (*A*), or it may be fastened by boring a hole through the plank large enough to allow the rope to be drawn up through and held secure by a large knot in its ends. This should be so arranged that when the hog is fastened to the plank it is about waist high, as shown in Figs. 111, 112, 113. The plank should assume a position of about 30 degrees. The operator, standing facing the plank, with his right hand toward the lower

Fig. 112.—Restraint for spaying operation (flank method): Second step.

end, passes right hand (*D*) through the loop (*C*), and instructs assistant to grasp right legs of the hog and bring the hog to him, placing it on the board. As the assistant approaches with the hog pass your left hand under the right hand and rope, grasping left hind leg (*E*), while your right hand grasps the right hind leg (Fig. 112). Now guide the left leg to your right hand, which grasps it. The left hand now contains both hind feet, while the right hand

grasps the loop from over left wrist and carries it back, dropping it above ankles. As you drop the rope back of the ankle you are to say "pull," meaning that your assistant is to pull the hog downward on the plank, making the rope taut, as shown in Fig. 113. With a little practice a sow can be secured by this method in less than five seconds.

Preparation for Operation.—One of the most important essentials to success in spaying sows is to have the alimentary tract absolutely empty before undertaking to operate. This can best be done by withholding the feed for from twenty-four to thirty hours

Fig. 113.—Restraint for spaying operation (flank method): Third step.

previous to operating. During this time there is no special objection to allowing the animal free access to water. The danger of septic infection can be greatly minimized by providing clean quarters before and after operation. Another essential is to not allow the boar access to the sow previous to operation. It is not best to operate during the period of "heat." Pregnancy is a contraindication to successful spaying.

Instruments.—Six-inch curved scissors for the purpose of removing hair from site of incision. Miles' hook knife (Fig. 114). Hagedorn half-circle needle No. 1 (Fig. 115). The Hagedorn needle is here specified in preference to all others, on account of its curved shape and cutting spear point. No. 12 braided silk and a sheep and swine emasculator (see Fig. 106).

Fig. 114.—Miles' hook knife.

Suturing of the wound is greatly facilitated if a pair of Richter's needle-holders are available.

Methods of Operating.—There are two standard methods—viz., flank and median line, or "belly." Each have their advantages

Fig. 115.—Hagedorn half-circle needle No. 1.

and disadvantages. However, taking everything into consideration, the writer greatly prefers the flank method.

Flank Method

Operative Technic.—Sterilize the instruments by boiling or otherwise. The animal should be properly secured (see Figs. 111, 112, and 113) and placed on the right side.

Remove hair from flank by clipping with scissors. Wash hands of operator and left flank of animal with 2 per cent. lysol solution. With hook knife (see Fig. 114) make oblique incision 1 inch to 1½ inches long, beginning high in the flank, 1 to 2 inches posterior (behind) the last rib. This incision should run downward and backward at an angle of 45 degrees (see Fig. 113, *O*). The incision

should penetrate skin, subcutaneous connective tissue, fat, and external and internal oblique abdominal muscles. By this we mean all tissues down to the peritoneum (lining of the abdominal cavity). The peritoneum is now carefully punctured with the point of the knife, after which stretch or enlarge the incision sufficiently to admit index-finger of the left hand. With this finger inside of abdomen the left (upper) ovary is located by passing the finger backward near fundus of bladder and upward toward vertebral column ("backbone"). The ovary can be readily distinguished from the other interabdominal viscera by its peculiar feel, as it consists of hard lobules arranged in cluster form, simulating small grapes. The left ovary and its accompanying Fallopian tube ("horn") are now drawn through the incision. In young sows the

Fig. 116.—*P*, Ovaries; *Q*, Fallopian tube ("horns"); *R*, emasculator.

left tube is now followed back to the bifurcation, where the right tube is encountered. The right tube is followed until right ovary is located, after which draw the ovary out of abdomen through incision and place both ovaries (*P*) in emasculator and sever same by closing handles of instrument. The tubes (*Q*) are now washed and replaced in the abdominal cavity (Fig. 116), after which the incision is closed by two interrupted sutures. These sutures should be made with a No. 1 half-circle Hagedorn needle and No. 12

braided silk. They should extend through all layers of the abdominal wall, including skin and peritoneum, or, in other words, should be what is known as the "through-and-through suture" (Fig. 117). Sponge off wound with antiseptic solution and release the animal.

In sows which have given birth to one or more litters of pigs the Fallopian tubes ("horns") are oftentimes so large that the left one must be replaced in the abdomen before the right is with-

Fig. 117.—Abdominal incision (*S*) closed with two interrupted sutures (*T*),

drawn. In such event, of course, only one ovary can be removed at a time. However, both ovaries can always be removed through the same flank incision.

Median Line or "Belly" Method

Operative Technic.—Sterilize instruments and wash hands same as for flank operation. With the animal properly secured in the hanging posture (Fig. 118), the hair is removed from site of incision, and parts cleansed with 2 per cent. lysol solution. With hook knife (see Fig. 114) begin incision 2 to 3 inches below pubis and ½ inch to either right or left of the median line. This incision should be extended downward about 1½ inches and should include all tissues of the abdominal wall, down to the peritoneum (Fig. 118).

The peritoneum is now punctured with the point of the hook knife, after which enlarge incision to admit index-finger of left hand. With this finger the ovaries and tubes are readily located near the median line of the body. They are drawn through the skin incision (Fig. 119) and removed with emasculator, same as by flank method.

The tubes are now sponged off with antiseptic solution, after

Fig. 118.—Sow properly secured for median line or "belly" operation: *A*, Wall; *B*, hook; *C*, cord; *D*, loops above hocks; *E*, incision.

which they are replaced in the abdominal cavity, and the wound closed by two or three interrupted sutures (Fig. 120, *F*), using the same needle and the same size silk as in flank method. The animal is now released.

Fig. 119.—*F*, Ovaries; *G*, Fallopian tubes or "horns"; *H*, emasculator.

Fig. 120.—Wound closed, "belly" method.

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